S. Hrg. 98-508

INTERNATIONAL STUDENT ACHIEVEMENT COMPARISONS AND TEACHER SHORTAGES IN MATH AND SCIENCE

HEARING

BEFORE THE

SUBCOMMITTEE ON ECONOMIC GOALS AND INTERGOVERNMENTAL POLICY

OF THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

NINETY-EIGHTH CONGRESS

FIRST SESSION

JUNE 15, 1983

Printed for the use of the Joint Economic Committee

U.S. GOVERNMENT PRINTING OFFICE
26-732 O WASHINGTON : 1983

J 841-6.

JOINT ECONOMIC COMMITTEE

(Created pursuant to sec. 5(a) of Public Law 304, 79th Congress)

SENATE

ROGER W. JEPSEN, Iowa, *Chairman*
WILLIAM V. ROTH, Jr., Delaware
JAMES ABDNOR, South Dakota
STEVEN D. SYMMS, Idaho
MACK MATTINGLY, Georgia
ALFONSE M. D'AMATO, New York
LLOYD BENTSEN, Texas
WILLIAM PROXMIRE, Wisconsin
EDWARD M. KENNEDY, Massachusetts
PAUL S. SARBANES, Maryland

HOUSE OF REPRESENTATIVES

LEE H. HAMILTON, Indiana, *Vice Chairman*
GILLIS W. LONG, Louisiana
PARREN J. MITCHELL, Maryland
AUGUSTUS F. HAWKINS, California
DAVID R. OBEY, Wisconsin
JAMES H. SCHEUER, New York
CHALMERS P. WYLIE, Ohio
MARJORIE S. HOLT, Maryland
DAN LUNGREN, California
OLYMPIA J. SNOWE, Maine

BRUCE R. BARTLETT, *Executive Director*
JAMES K. GALBRAITH, *Deputy Director*

SUBCOMMITTEE ON ECONOMIC GOALS AND INTERGOVERNMENTAL POLICY

HOUSE OF REPRESENTATIVES

LEE H. HAMILTON, Indiana, *Chairman*
AUGUSTUS F. HAWKINS, California
OLYMPIA J. SNOWE, Maine

SENATE

LLOYD BENTSEN, Texas, *Vice Chairman*
ROGER W. JEPSEN, Iowa
ALFONSE M. D'AMATO, New York

CONTENTS

WITNESSES AND STATEMENTS

WEDNESDAY, JUNE 15, 1983

Page

Bentsen, Hon. Lloyd, vice chairman of the Subcommittee on Economic Goals and Intergovernmental Policy: Opening statement ---- 1

Turnbull, William W., former president and distinguished scholar in residence, Educational Testing Service, Princeton, N.J ---- 3

Reagan, Billy R., general superintendent, Houston Independent School District, Houston, Tex ---- 32

O'Neal, Barbara, president, Texas State Teachers Association, Austin, Tex ---- 99

Pyle, Betty, president, Texas Classroom Teachers Association ---- 104

SUBMISSIONS FOR THE RECORD

WEDNESDAY, JUNE 15, 1983

Pyle, Betty: Prepared statement ---- 109

Reagan, Billy R.: Prepared statement, together with exhibits ---- 38

Turnbull, William W.: Prepared statement, together with addenda ---- 8

INTERNATIONAL STUDENT ACHIEVEMENT COMPARISONS AND TEACHER SHORTAGES IN MATH AND SCIENCE

WEDNESDAY, JUNE 15, 1983

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON ECONOMIC GOALS AND
INTERGOVERNMENTAL POLICY OF THE
JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10 a.m., in room 562, Dirksen Senate Office Building, Hon. Lloyd Bentsen (vice chairman of the subcommittee) presiding.

Present: Senator Bentsen.

Also present: George R. Tyler, professional staff member.

OPENING STATEMENT OF SENATOR BENTSEN, VICE CHAIRMAN

Senator BENTSEN. The hearing will come to order.

Good morning. We'll operate today's hearing as a panel. The subject of this hearing is to point out what is happening in the way of the competition with foreign countries and how they are progressing when compared with this country in the subjects of math and science.

In addition, we will be looking at the shortages of qualified math and science teachers in our elementary and secondary schools, and what is being done today to reduce that shortage and improve student capabilities in these technical subjects.

Since the dawn of the 19th century, this country has been the world leader in technical education. That leadership has resulted in a flow of new products coming out of laboratories and out of our schools enriching our lives and adding to the standard of living of our people. But now that leadership is eroding away. It has been built on innovation and our ability to translate the fruits of these laboratories into products for all of us.

The key to that process and the millions of jobs it has created is the topnotch education in technical areas of math and science which we have traditionally provided our students.

The breadth and the depth of our math and science education has been the envy of the world. Indeed, our foreign competitors realized that they had to match it if they were going to try to stay up with us. And they have done a great deal about it.

We have seen the Soviet Union and the Japanese pour extraordinary amounts of national resources into science and math education, just as we had done. But now we see that our progress is beginning to drift sideways, or even downward with a steady erosion of our international pre-eminence in science and math education. Our best students can still compete with the best abroad. But that top crust in this country is a very thin layer, indeed.

The recent report of the President's National Commission on Excellence in Education states: "What was unimaginable a generation ago has begun to occur—other nations are matching and surpassing our educational attainments."

Evidence of our lagging math and science education emphasis is widespread and compelling:

From the sixth grade on, students in nations like Japan and Germany receive about three times more classroom time devoted to math and science than received by the most technically oriented U.S. student.

Two-thirds of our States require graduating high students to take only 1 scant year of math and science. There are seven States that have no such requirement at all.

In Japan and Europe, college-bound students receive only half of the vacation time received by United States students. In addition, they attend school 1 or 2 hours longer each day.

United States students rarely score at the top on international achievement tests, and more often than not, they score at the bottom.

The reason for this lagging performance and the need for greater emphasis on math and science is straightforward. Our Nation has a severe shortage of teachers who are both interested in and qualified to teach math and science. In fact, one study has found that as many as one-half of all elementary and secondary math and science teachers are not certified in those subjects. Forty-three States reported serious shortages of math teachers last year and 42 reported shortage in science areas like physics.

The cause of that shortage is very clear—money. Teachers with solid math and science backgrounds can generally earn one-third or more in private industry than they can as teachers. And for many, that lure has been irresistible. They have had no choice, because they're concerned about the welfare of their families.

The result is fewer course offerings in math and science by our school systems and slackening in quality, as well.

There are some schools, some school districts and some States that are fighting back. I think a good example of that is the Houston school system and others in Texas that have been making successful strides in eliminating these shortages, shortages which also exist in other areas such as special education and foreign language instruction.

The ability of our Nation to conduct an adequate national defense and to retain leadership in emerging technologies and the jobs they create, depends on a technically oriented work force. Both of these national objectives are in jeopardy to the extent that our students are being short-changed by the lack of math and science teachers. And as the President's Commission noted, there is a substantial role which the Federal Government must play in addressing these and other educational deficiencies.

The first step in crafting such a role is to carefully define the problem. First, we're going to hear from Mr. William Turnbull, Distinguished Scholar in Residence at the Educational Testing Service in Princeton. Mr. Turnbull, who is the immediate past president of ETS, will review findings for us which will shortly be published in an ETS report on student math and science performance here and abroad.

He will be followed by Mrs. Barbara O'Neal, the president of the Texas State Teachers Association; Ms. Betty Pyle, who is president of the Texas Classroom Teachers Association; and Mr. Billy Reagan, general superintendent of our Houston school system. They are going to discuss the teacher shortage specifically in Texas, and review some of the steps being taken to ease those shortages.

I appreciate the willingness of these witnesses to appear and their deep concern for the problems that are affecting our Nation in education. I have specifically invited them because they are doing something about it.

I'd like to start now with Mr. Turnbull, if you will proceed with your testimony.

STATEMENT OF WILLIAM W. TURNBULL, FORMER PRESIDENT AND DISTINGUISHED SCHOLAR IN RESIDENCE, EDUCATIONAL TESTING SERVICE, PRINCETON, N.J.

Mr. TURNBULL. Thank you, Mr. Vice Chairman. Ladies and gentlemen. It's a privilege to present my views on the critical questions you have put before us, Senator Bentsen. They seem to boil down to how to see to it that the young people who are now in the schools of this country will be well prepared to take their places as individuals in the new era of technology and to maintain for the country the leading role that has been ours, that can be, and that must be ours in the future.

My thesis is that such a leadership role will not be sustained if we take a business-as-usual approach to either our economic or our educational arrangements. A determined effort now, however, can reinforce this country's place in the forefront of technological advance and do it for years to come.

My full prepared statement is in your hands. In it I propose specific moves that I would recommend with particular reference to a constructive Federal role which I feel is essential. Although schooling in its specifics is left to State and to local authorities, educational policy must not be abdicated by the Federal Government if we're to realize our aims. Firm and sustained educational leadership at the national level is needed in any country that would itself lead.

First, I think we should look at the participation of high school students in math and science courses now as compared with previous years. And let us start with the good news. According to data from the college board, students who registered for the college admissions program in 1982 had taken more courses in math and science than in any year since the data collection was begun in 1973.

With respect to their intended fields of study in college, more good news. The interest in computer sciences jumped by 38 percent last year alone. It has quintupled since 1975. Interest in engineering at the college level continues to increase and is up by 40 percent since 1976 for men, for whom engineering is now the most popular intended field of study. Nearly a quarter of the men put it in first place. The increase is much faster for women, although it is accelerating from a very small base.

I'm afraid that there is more than enough bad news to balance the good. Only about 1 percent of high school seniors intend to major in mathematics in college. About 2 percent in physical science, no more than 3 percent in biological science. This is down about a third over the past half dozen years.

In general, also, scores from a variety of achievement testing programs such as the National Assessment of Educational Progress shows at the 17-year-old level declining trends in scores, especially scores on abstract reasoning and problem-solving questions rather than on questions involving only mechanical skills like computation. This is a disturbing finding and it runs contrary to the popular wisdom that says that students just don't learn the mechanics these days. They are learning the mechanics better than they are learning to reason on the basis of the problem as given.

This decline in the reservoir of higher order skills and information at the command of high school graduates is really a stark contrast to the dramatic rise in the importance of science and of technology in our society.

The well-publicized decline in scholastic aptitude test scores, SAT scores, over the past 20 years is consistent with those findings from achievement tests. The decline does reflect in part the greater holding power of the schools for students of relatively low academic attainment; whereas previously, they might have dropped out, now they are staying to complete more years of school, which is good.

The result, however, is a decrease in the average scores for the group as a whole. That decline, interestingly, is more pronounced in the verbal than in the mathematical portions of the test. We are seeing in all of these scores an increasing knowledge gap between the most highly trained students who, as you said, are holding their level of achievement, and those whose studies are less advanced. That may be translated into a gap between the future innovators and the people who need for our society to be literate citizens rather than experts in scientific matters.

The knowledge gap is further evidenced by the fact that about one-third of U.S. secondary schools do not offer enough mathematics to qualify their graduates for admission to accredited engineering schools. We are cheating the students in those secondary schools of the opportunity to be part of the technological revolution that is on us. Fewer than a third of U.S. secondary schools offer physics courses taught by qualified physics teachers. Only 9 percent of the students who are graduating from vocationally oriented secondary school programs as late as 1980 took 3 years of science. Only 18 percent took 3 or more years of mathematics.

These figures, to my mind, are pathetic.

Now let us consider for a moment the demographics and their implications. We are coming into a period when secondary school students will be increasingly rare commodities. That is the inevitable result of declining birth rates that were going down until the mid-1970's. With the contrary trend of an aging population, more people will be retiring from our work force every year. These and other forces point to a shrinking labor force, one in which people with highly developed skills are going to be at a premium. That underscores our need to make the most of the talent and resources that are available to us.

That decline in births was greatest in the white middle-class families, families whose children historically have completed the most years of education, especially in math and the sciences. We need to redouble our efforts to persuade and assist young people from poor families, especially minority students, who have been underrepresented in the math and science fields in the past and therefore, who have been hard put to it, to qualify for the kinds of jobs that are likely to be in demand, for those who stay in school and develop their talents in quantitative subjects.

This is a time highly favorable to rectifying the gross disparities among economic and racial groups in education and employment in technical areas.

Young women make about the same grades as boys in their high school math and science, perhaps contrary to popular opinion. In college, they are beginning to enter the quantitative fields in greater numbers. But boys still outnumber girls about 3 to 1 among students interested in concentrating on physical sciences and related areas in college.

If girls could be encouraged to continue in those fields at the same rate as boys, we could increase output of trained scientists by 50 percent. There is no magic wand that I can wave to bring that about. It is going to happen only if and when employers cease to discriminate against women in traditionally male jobs in the society.

Turning to comparisons with other countries, our future in world trade, of course, is closely linked to our progress as a Nation in technology. It is clear that we have stiff competition in that area, especially from Japan. Also from other developed and some less-developed countries. Part of the threat to our leadership comes from the fact that the school systems in most of the competing countries are more rigorously academic. They are more selective in higher grades. They demand longer hours of study than is true in this country.

Accordingly, when one compares the academic achievement of our mass of students at the end of high school with the attainments of their selective group, U.S. students as a whole do come out very badly, usually at the bottom. When one compares the top 4 or 5 percent, anywhere from 1 percent up to 10 percent of students in several countries, including our own, ours come out about in the middle, no better than that. Probably a little worse.

An also-ran position now, a position in the middle of the educational pack, is a sure recipe for mediocrity in our international trade position in a few years. And with our leadership in expertise and innovation, surely will go our markets and our prosperity.

We cannot put all the responsibility for what is learned in school on the teachers, the curriculum or the time spent in class. A case in point—Asian-American children learn more math and science in American schools than any other group. Those schools and their programs are the same. Asian-American children study harder, especially at home. We have to look at the values that their parents hold, the values that they inculcate in the children, and ask if the difference in performance is due to the expectations of the broader American society rather than or perhaps in addition to the expectation and actions of the schools.

On teaching staff in 1981–82, among high school seniors on taking the SAT, who listed education as their intended area of study in college, only the best 35 percent did as well as the average person who took the test. Ony 17 percent of those who say they're going into teaching do as well on the math portion of the SAT as the average person who intends to major in math or science in college. Our society is managing to drive the best students away from education and later, away from teaching as a career.

My statement focuses mainly on our immediate concerns—that is, mathematics and science. The intellectual resources of the Nation will be inadequate unless we have an educational system of breadth as well as of specialized strength. We properly deplore two decades of decline in mathematics reasoning scores. At the same time, we must be aware that the same two decades have brought declines twice as great in reading and verbal reasoning scores.

We need to concern ourselves with the condition of education across the board. A partial, lopsided attack on educational quality, I think, is doomed to failure.

Many people have compared our present period of concern about education to the one that followed the launching of Sputnik more than a generation ago. As time passed, our sense of an educational emergency diminished until the falling test scores and rising imports revived that sense of emergency. But we cannot depend on an educational commitment that comes to life only when a Sputnik or, let us say a Sony, may arouse it every 20 to 30 years. We need to look not only for some rapid emergency change, but also for those deeper seated alterations in attitudes and practices and especially in structure that will maintain the momentum of the improvements we adopt that will assess their effectiveness and that will permit us to learn cumulatively from our experience, something that we have not done very well.

Now most of us are acutely aware of the number of study groups that have been set up to examine the state of education and reported their findings, most of them not very positive, and their recommendations to the Nation in recent months.

It is useful to have a wealth of ideas brought to national attention, but they now need to be sifted. The best of them should be brought together into a more cohesive vision of what we want to achieve and how we want to achieve it. That undertaking should be sustained long enough to find out, to find out through research and evaluation, what seems to work or not to work and in what settings and thereby to allow us to build a cumulative understanding of how we can best move forward to improve education in this country.

A continuing policy commission on precollege education should, I believe, be appointed to a minimum of 5 years, renewable for up to another 5, appointed by the President or perhaps the Secretary of Education. Commission members should include many segments of society, including business and labor and government and many more, in addition to educational administrators and researchers. Such a commission should have a purview that extends across all of precollege education, with science and mathematics certainly high on the list for priority attention.

More specific recommendations in my full prepared statement include higher compensation for all teachers, plus pay raises or bonuses for merit and for fully qualified teachers in fields such as mathematics, in which we suffer a severe shortage. I am in favor of revamped curriculums to meet new needs, and of much greater use of technology in the instruction of both teachers and students. We need statewide testing programs that recognize honors work, as well as minimum competency. And we need a school year that is lengthened through more classroom hours and through more homework assigned. We need better guidance to urge girls to keep on with their math and to encourage minority students to tackle quantitative fields.

Finally, we need strong policy guidance at the national level, bringing to bear the insights of people in government, business, and the education community on the solution of problems that affect the interest of us all.

In conclusion, Senator, we face clearly a long-term problem calling for long-term solutions. But we cannot wait years to take action. We need to begin now. I hope this subcommittee, this hearing, perhaps, will start a chain of events that will have repercussions for decades in all of education, as well as in America's economic future.

Thank you.

[The prepared statement of Mr. Turnbull, together with the attached addenda, follows:]

PREPARED STATEMENT OF WILLIAM W. TURNBULL

SCHOOLING FOR THE AGE OF TECHNOLOGY: WHERE DOES AMERICA STAND?

Mr. Chairman, Mr. Vice Chairman, Honorable Members and guests:

It is a privilege to present to you my views on a critical question for our society: how to see to it that the young people now in America's schools will be well prepared to take their individual places in the new era of technology and to maintain for this country the leading role that can and should be ours.

It is my thesis that a leadership role cannot be sustained if we take a "business as usual" approach to either our economic or our educational arrangements. But a determined effort now can reinforce this country's place in the forefront of technological advance for decades to come.

All of us see that the technological age is already upon us. Perhaps none of us fully realizes the speed and the power of the Information Revolution, which rivals the Industrial Revolution in its scope and significance. We are watching an economy shed its skin. The metamorphosis confronts us with new needs and presents us with remarkable new opportunities. The question is: will we have the highly trained people needed to discover and develop those opportunities, the skilled work force to operate complex systems, and a citizenry that supports rather than constricts or opposes the investments of time, money, energy and educated brainpower that will be needed?

Parts A through E of this Statement present the problems we face in achieving the educational underpinnings necessary for our future technological success. Parts F and G propose specific moves I would recommend for attacking those problems, with special reference to a constructive federal role. Although schooling in its specifics is left to state and local authorities, educational policy must not be abdicated by the Federal Government. Firm and sustained educational leadership at the national level is needed in any country that would itself lead.

A. Math, Science and Technology: Who Needs Them?

Discussions of the adequacy of present and future needs for knowledge about the hard sciences are sometimes confusing because different discussants have in mind the needs of quite different segments of the population. It is helpful to distinguish 3 groups, acknowledging that they overlap to a degree. They are, respectively, the innovators, the appliers, and the observers.

The innovators are that small group of people who are working actively in research and development in math, science and engineering. It is vital to the whole enterprise that they be exceedingly able, ingenious well-trained people in jobs that provide incentives for making the breakthroughs on which future progress will depend. Numerically, this group will clearly continue to be small. It is a group that the society must value highly and for which we must provide strong support in the form of postgraduate education, the best in equipment and attractive salaries.

The explainers and appliers are people who work at jobs requiring the ability to reason with numbers and an understanding of science concepts. They are the operators and translators and teachers rather than the innovators. In the classroom they must understand their subjects clearly and in the workplace they must be able to recognize the capacities and limitations of the techniques they apply or the equipment they use. In general, they need education in math and science at the college level.

People in the third group — the observer-participants — make up the bulk of the society. Their needs are not those of the specialist or the teacher or operator. They make up the informed citizenry, whose sophistication is vital to the shaping of national priorities in a new era. They include the taxpayers of all ages, retired or still working. They need an understanding of science concepts if they are not to live as aliens in their own land. Their support is needed for action in both private and public sectors — action ranging from federal legislation on international trade or national fiscal policy to the passing of local bond issues to introduction of technological changes in production or service enterprises. They include the leaders in business, the entrepreneurs, the financiers who back them and the investors who support their enterprises. Perhaps most important, they are the parents whose assumptions, whose values and whose hopes and plans for their children will be shaped critically by the depth of their perceptions of the changes in a society increasingly dominated by advances in technology.

B. Student Participation and Accomplishment

1. Comparisons with the Past

First, the good news.

With respect to student participation in school science and math courses, the comparisons with the past are perhaps a little better than is widely believed. Pertinent data have been published by the College Board relating to the million or so high school students who take the Admissions Testing Program each year. In 1982, they report:*

> "o Students took more courses in mathematics and physical science in high school than ever before [since 1973]. The increase in the study of mathematics by women has been twice that of men."
>
> "o The most dramatic growth in interest in intended college study occurred in computer sciences. In the past year it increased by 38 percent. Interest has tripled since 1978 and quintupled since 1975."
>
> "o The seven-year increase in interest in engineering continued into an eighth year. As in previous years, most of the increase was for men, for whom engineering is most popular (approximately one-in-four)."

This latter figure, for men, is up by about 40 percent since 1976. The corresponding figure for women is up an encouraging 170 percent, but from such a low base — 1.4 percent in 1976 to 3.8 percent in 1982 — that the absolute numerical increase is still small.

There is more bad news than good. Over the same six-year period, since 1976, the proportion of seniors taking College Board tests who intend to major in biological sciences in college has dropped from 4.8 to 3.2 percent, in physical sciences from 2.4 to 1.9 percent, and in mathematics from 1.9 to 1.1 percent. These are large drops and by 1982 we see percentages of high school seniors intending to major in math or science: about 1 percent in math and 2 or 3 percent in science.

These data on intended areas of study in college say little for the depth of interest and excitement that the students have carried away from their precollege exposure to math and science.

Numbers of students enrolled or planning to enroll in various courses of study are one thing; comparative academic proficiency is another. The data on what the students have learned present a mixed picture. In general, the National Assessment data on science covering the years 1969, 1973 and 1977 show a pattern of fairly steady achievement at the 9-year-old level but of declining scores at the 17-year-old level. The picture in mathematics is similar. The decline in the reservoir of information and skills at the command of high school graduates stands in stark contrast to the dramatic rise in the importance of science and technology in our society.

---

*National College-Bound Seniors, 1982, p. 3. Available from Educational Testing Service, Princeton, N.J. 08541.

The most disturbing finding about trends in science and math scores is that the declines have been concentrated in those parts of the tests that demand higher-order skills — abstract reasoning and problem-solving — rather than mechanical skills such as computation. This pattern runs counter to the popular wisdom which says that students "just don't master the mechanics these days."

It is well known that scores on the SAT, which stresses reasoning with word and number problems, have declined for nearly 20 years. The drop has been more pronounced in the verbal than in the mathematical section. The downward shift reflects in part the greater holding power of the schools for students of relatively low attainment, with a consequent increase in low scores and therefore lower average scores for the group as a whole. The decline also reflects a decrease in the number and proportion of high-scoring students, however. Fewer of our most talented youth are gaining the quality of mathematical reasoning skills that top students were acquiring 10 or 20 years ago. Over the past 5 years, the percentage of students scoring above 700 — a very high score — on College Board science and math achievement tests has declined slightly but consistently: 5 percent fewer in Advanced Math, 1 percent in Biology, 1 in Chemistry, 2 in Physics.

There is, however, a bright spot in the data on achievement. Jones* studied the scores made by students who took the demanding Advanced Placement Tests of the College Board. These scores "are used by colleges in placing or sectioning students, especially in the freshman year," and "most students who take them probably intend to major in science or mathematics." The results show that "the high school students who took advanced placement tests in science or mathematics in 1979 performed about the same as those who had taken the tests 6 years earlier."

The participation and accomplishment of students in advanced high school courses in science and mathematics is of critical importance to our output of future innovators, explainers and appliers. Of greater importance to the scientific literacy of the society at large — the observer-participant group — is participation at all grade levels in courses that introduce them to scientific concepts and help prepare them to cope with future issues in technology. At this basic level, we are failing disgracefully to provide the necessary educational opportunities. As was pointed out in 1982 by the National Science Board Commission on Precollege Education on Mathematics, Science and Technology:**

---

*Jones, Lyle V. "Achievement Test Scores in Mathematics and Science." Science, Vol. 213, July 24, 1981, pp. 412-416.

**National Science Board. Today's Problems, Tomorrow's Crises. A Report of the National Science Board Commission on Precollege Education in Mathematics, Science and Technology. P. 3. Washington, DC: National Science Foundation, October 1982.

> ". . .adequate mathematics and science course opportunities are not available for all talented and motivated students. As many as one-third of U.S. secondary schools do not offer sufficient mathematics to qualify their graduates for admission to accredited engineering schools. Only one-third of the 21,000 U.S. high schools teach calculus, and fewer than one-third offer physics courses taught by qualified physics teachers."

Taken together, the data suggest that the sophistication of the most highly trained student group, from which perhaps most of our "innovators" and many of our "appliers" will be drawn, has at best held its own since Sputnik while the knowledge of the end-of-school group taken as a whole has dropped. We can perhaps see a continuation if not an intensification of the math-science knowledge gap between the innovators who depend on a favorable climate for support of their work and the observers whose understanding is critical to maintaining that climate and the flow of that support, whether through public or private channels. The same conclusion was reached by the Commission on Precollege Education in Mathematics, Science and Technology:*

> "The evidence on student participation and achievement indicates a wide and increasing divergence in the amount and quality of the mathematics, science and technology education acquired by those who plan to go on to college and study in those areas and by those who do not. Students in the latter category generally stop their study of mathematics and science at a relatively early age, perform considerably less well on achievement measures than the career-bound, and do not have opportunities to pursue appropriate courses in contemporary technology. Only nine percent of the students graduating from vocationally oriented secondary school programs in 1980 took three years of science, and only 18 percent took three or more years of mathematics."

2. Demographics and their Implications for the Future

National demographic trends make it clear that we must count on fewer rather than more young people in the education system. We are headed for a drought of new talent — a steady drop in the numbers of young people we must count on to develop the expertise we need for the future. Annual birthrates in this country declined through 1974 and began to turn up again only in 1976. The all-too-familiar result has been the closing of elementary schools and declines in secondary school populations. While the elementary school numbers should soon begin to rise, the slump in secondary school enrollments will continue until the middle-to-late 1990's.

While the supply of people newly trained to take their places in advanced study or in the work force declines, the number of people retiring from employment will increase as the population ages. The influx of women into the job market may well continue but probably at a slower rate than in recent years. These trends point to a shrinking labor force in which people with highly developed skills will be at a premium, underscoring our need to make the most of the talent resources available to us. The shortage of trained talent will be especially acute if the economy is strong.

---

*Op. cit, 1982.

It is worth noting that the decrease in the high-school-age population in the next decade will not be uniform across all subgroups in this country. It will be most marked in white middle-class families, from which high school graduates come in the greatest proportions. It will be least severe, if it exists at all, in the historically disadvantaged subgroups whose birthrates are higher. At present, a relatively small proportion of "disadvantaged" children continue in school to receive a high school diploma, especially with an academic rather than a general or vocational concentration. The proportions differ markedly also among racial and ethnic groups. While some 40 percent of Asian-American and over 30 percent of white students receive "academic" diplomas, only around 20 percent of Black and 10 percent of Hispanic or native American students do so. Accordingly, among the latter groups the enrollments in math and the sciences are quite low.

The conclusion must be drawn that the decrease in the pool of young people with training in high school science, especially at the level required to continue on as a college major in a technical field, will be even sharper than the aggregate birthrate statistics would suggest. The other and brighter side of the coin is that the shortage may create a climate unusually favorable to persuading disadvantaged students, their parents, and the educational community that much large numbers of these young people should continue in school, especially in quantitative academic fields. Their present underrepresentation is an educational and social tragedy. We are likely soon to see that it is also an economic threat both to educational institutions that are short of students and to corporations that are short of well-educated entry-level people. The confluence of social, educational and economic considerations may push us to try to accelerate the process of achieving something closer to demographic parity in education.

Another underrepresented group in mathematics and science fields is women. It is well known that in high school, girls take fewer of the courses in those fields than boys. In the College Board sample, males take an average of 3.72 hours of study in high school math courses versus 3.44 for females. In physical sciences, the numbers are 2.03 for boys, 1.63 for girls. Only in biological science courses do the girls take slightly more hours: 1.42 versus 1.39 for boys. When one looks at grades in the highest courses taken, however, girls stand a little higher than boys in biological science and receive virtually the same grades in both math and physical science. But there are sharp sex differences in their plans for future study. Among students naming "Physical Sciences and Related Areas" as their first choice among intended areas of study in college, boys outnumber girls about 3 to 1. If we could magically make that discrepancy disappear, we would increase the supply of intended majors in math and physical science by nearly 50 percent. We all know the magic wand is not available, but as the society adopts and transmits to young people more enlightened attitudes about what it is proper for women to do, we will find an enormous reservoir of undeveloped math-science talent in the female population. That fact and the opportunities it implies need to be communicated to parents, teachers, guidance people, and especially to young (and not so young) women themselves. This will happen only if and when employers cease to discriminate against them in traditionally male jobs.

3. Comparisons with Other Countries

Obviously, the United States is in competition with all other developed countries in its world trade. In the next decade or two, technology and its broad application seem likely to lie at the heart of what other countries want to buy from us or from our competitors. Only a few years ago it was realistic to think of Western Europe as the competition. More recently, Japan has become the major threat to American dominance of export markets in technology, with the broader category of competition encompassing other East Asian countries such as Taiwan, Korea and Hong Kong. Accordingly, a few words about the educational systems in the Far East and especially in Japan are in order.

First, it is true that the Japanese educational system and its imitators in Asia are more competitive and rigorous than our own system. That means we will fall behind Japan in science, math and technology quite steadily for years to come unless either we change or they do. Japanese students probably spend 30 percent to 40 percent more time on their studies than do American children, and even more than that in math and science.

Second, we can overdo the comparison if we concentrate on the Asian educational system. We need also to look hard at the behavior of the children who attend the schools. They work hard! Strenuous application to study is something that the Asian children know is expected of them. Family arrangements and family values are geared to maximizing the academic accomplishments of young people. These attitudes are carried over when the parents come to the United States, and all of us are familiar with the high academic standards attained by East Asian students in our own schools, especially in the sciences and mathematics. Moreover, Asian children outscore all others, including white Americans, on the SAT-Math test. This phenomenon of high accomplishment suggests that the organization of the school and the content of the curriculum may mean less than how hard the students are prepared to work — or are required to work — whether they are living and going to school in America or in Asia.

A great deal of attention has been paid to the fact that, in international comparisons, American high school students do far worse on average than students in other countries who have gone through the same number of years of study. We are at the bottom of the heap. That is not the whole story, however. As Torsten Husén has written* recently:

---

*Husén, Torsten. "Are Standards in U. S. Schools Really Lagging Behind Those in Other Countries?" Phi Delta Kappan, March 1983, pp. 455–461.

> "When the IEA mathematics study compared the average performance in different countries of students in the terminal grade who were taking mathematics, we found that American high school graduates were far below those of other countries. In the U.S., however, 18% of the age group of 17- to 18-year-olds took mathematics, compared to 4% to 5% in some European countries. In order to gauge the feasibility of producing an elite in a comprehensive system of schooling, one must compare equal proportions of the relevant age group in the respective countries. . . . The range between countries is more narrow for the elite than for the entire group of terminal mathematics students. The top 4% of U.S. students score at about the same level as the corresponding group in other countries.
>
> Similar comparisons were conducted with terminal students in science. . . . By and large, the same picture emerged when countries were compared with regard to the top 5% and 1% of their students.
>
> The assessment of the standard of elite students at the pre-university level does not support the contention that systems with broader access and with relatively high retention rates through upper secondary school do not succeed in producing elite students. An elite can be cultivated within a comprehensive educational system."

Thus the international comparisons, like the data on changes over time in this country, suggest that the performance of top students in America holds up reasonably well. Whether we can afford simply to be in the middle of the pack internationally and merely to do no worse than we did several years ago in this country is another matter. I hope we will answer a resounding "No!" It will be a travesty if we in this country, with the resources we have at our command, let our scientific and technological leadership slip from our grasp. We should make no mistake: with that leadership will go our markets and our prosperity.

C. Teaching Staff

For many years it has been reported that young people electing to enter teacher training programs made relatively low average scores on tests of academic ability. This condition has persisted: in 1981-82, high school seniors taking College Board exams who listed Education as their intended area of study in college averaged 394 on their verbal tests and 419 on mathematical reasoning for a total of 813 on the two, 80 points below the average of 893 for all students tested. In contrast, young people planning to study mathematics or physical sciences attained average SAT verbal scores of 442 and math scores of 524 for a total of 966, or 73 points above the general average and more than 150 points above the average of those who listed Teaching as their intended area of study.

Only the best 25 percent of the intended education students do as well as the average person who takes the test and only the best 10 percent do as well as the average person who intends to major in mathematics or physical sciences.

It is somewhat reassuring to reflect that some of the young people who identified math or science rather than education as their intended area of concentration will wind up in teaching. This is especially true at the secondary rather than the elementary level. But the early grades are extraordinarily important: if children are not taught science and math well in their earliest years, it is unlikely that they will elect further courses in those subjects when they have a choice of programs in secondary school.

We seem to be caught in a particularly vicious trap in the teaching field. The prestige and the compensation accorded to teachers are both low. The result is the flight of many capable people from both teaching and teacher training. School boards and local groups are reluctant to vote any substantial salary increases for teachers who, they argue, are below the level of competence needed to justify higher pay. The public won't pay better until they believe teachers deserve it and the best-qualified people academically won't go into teaching until the rewards are greater. This is true across the board but is especially troublesome in the fields of math and science where the competition of industry with academe is particularly severe: a well-trained teacher of science can often make 50 percent to 100 percent more money in corporate work than in teaching.

A solution frequently proposed is a pay increase for teachers of science and math, creating a differential between them and teachers of other subjects. This approach is strongly opposed by the National Education Association and the American Federation of Teachers, which argue that the proper course is to raise teacher salaries across the board but to avoid the divisive step of creating salary differentials. This argument would be compelling if we were facing a minor problem or one likely to solve itself in time. We are not in a business-as-usual situation, however. The need for action is urgent. We need desperately to break out of the trap we are in, as discussed later under Recommendations.

D. Some Overall Observations

This statement has focused mainly on our immediate concerns: mathematics and science. But the intellectual resources of the nation will be inadequate unless we have an educational system of breadth as well as of specialized strength. While we properly deplore two decades of decline in mathematics reasoning scores, we must be aware that the same two decades have brought declines twice as great in reading and verbal reasoning scores. A partial, lopsided attack on educational quality will not succeed.

We also have to see that we cannot look only to the schools for our solutions. The attitudes of parents toward study, the demands of the community as to what the school should teach, the entry requirements established by employers and by colleges, and the expectations of the larger society as to the standards that young people should meet — all of these play major roles in determining the quality of education.

For this and many other reasons, strong national leadership is required if we are to reach our goals not only for the schools but for America as a learning society.

It is difficult to mobilize the country to a sense of urgency and commitment to the improvement of education. It is many times more difficult to maintain that commitment over a long period.

We are now worried — and properly so — by the inescapable evidence of lack of skills on the part of our high school graduates. Many people have compared our present period of concern about education to the one that followed the launching of Sputnik more than a generation ago. Sudden realization of our lagging progress in the space race against our chief military rival was the spur then, but over time our sense of an educational emergency diminished until falling test scores and rising imports revived it.

We cannot depend on an educational commitment that comes to life only when a Sputnik or a Sony arouses it every twenty to thirty years. We need to look not only for some rapid change but also for those deeper-seated alterations in attitudes, practices and structures that will maintain the momentum of the improvements we adopt, assess their effectiveness, and permit us to learn cumulatively from our experience.

E. A Continuing Policy Commission on Precollege Education

Most of us are acutely aware of the number of study groups that have been set up to examine the state of education and that have reported their findings to the nation in recent months. These reports by thoughtful people have been provocative and challenging rather than reassuring. They have been accompanied by a wide variety of recommendations for changes, major or minor.

It is useful to have a wealth of ideas brought to national attention. Clearly, however, they now need to be sifted. The best of them should be brought together in a more cohesive vision of what we want to achieve and how we want to achieve it. This should not be an effort de novo but should be built mainly on the most promising recommendations already on the table. The undertaking should be sustained long enough to find out what seems to work or not to work, in what settings, and to allow us to build a cumulative understanding of how we can best move forward to improve education in this country.

The Continuing Policy Commission should have a purview that extends across all of precollege education. Certainly science and mathematics should be high on the list for priority attention, but we need to recognize that a change made in any one curricular area will affect all others: e.g., unless the number of school hours is changed, an increase in time for one subject means a decrease for another.

I know of no single agency that now has the internal resources to perform the integrative job that needs to be done. The task of analysis and synthesis will require the contributions of well-informed people in educational administration, teaching, curriculum guidance, research, school finance, business, manpower, and governmental processes at federal, state and local levels. The issues deserve the best brains we can muster from both public and private sectors to mount an effort that is searching and, above all, sustained. The task will not be easy or quick but it is essential if the study efforts of the recent past are to be put to use rather than gather dust.

The Continuing Policy Commission should be appointed for a minimum of five years, renewable for up to another five, by the President or the Secretary of Education with advice from representatives of the several groups at interest. It should be action-oriented in its policy conclusions but its function should be advisory to the agencies that have responsibility for the actions needed. Its authority would be derived from the cogency of its recommendations and the support they would engender, especially in the public at large.

The Commission's mandate would be to develop recommendations for improving education and to disseminate them broadly. Further, the Commission would be expected to seek out instances of the application of the recommendations and to evaluate and disseminate the results. A small, competent staff would be required. Work would be shared with or done by government agencies at the appropriate levels or contracted out, as appropriate.

In the following section, over two dozen ideas of the kinds suggested by recent panels, but including several not previously proposed, are brought together to illustrate the range of proposals that should come before the Commission. Many of them, however, may be sufficiently promising or urgent that we should act on them immediately, without waiting for a Commission. Those that in my opinion should be stimulated and led at the federal level are asterisked.

F. Other Recommendations

1. Proposals Having to Do with Teachers

Attracting, recruiting, selecting and retaining first-rate teachers is a necessary precondition for a first-rate school system. I believe we have a great many excellent teachers now. I also believe that there is room for improvement.

*a. Teacher Compensation

I join with a majority of those who have studied this matter in believing that teacher compensation should be raised. This is a key issue for teachers in all subject areas, across the board, in both elementary and secondary schools. An increase

> in compensation of 30 percent over a three-year period, relative to salaries in other occupations, would pay enormous dividends in quality for years to come.
>
> The cost of such a step would be enormous: about $4.3 billion per year for a 10 percent increase and, obviously, triple that figure for 30 percent. The investment is one that we are going to have to make if we want better schools and better-trained students in all fields, including science and mathematics in particular because of the stiff salary competition from nonteaching jobs.

*b. Differential Compensation

> The controversial subject of pay differentials should be studied closely. The time is at hand to explore the options here and to assess efforts that are being made in different parts of the country to apply differential pay according to merit or teaching field (i.e., adopting higher scales for teachers in fields to which it is hard to attract qualified instructors). Bonus systems should be examined as promising alternatives to building differentials into basic pay scales.

This is one of the recommendations that I believe should be acted on immediately, with a bonus of 10 percent by 1985 for all fully accredited teachers of science and mathematics in a school district who have at least a Bachelor's degree in the subject they teach. This increment would be followed by an additional 10 percent in each of the following two years. I would urge that AFT and NEA representatives be brought into discussions of how such a plan would be implemented. I would suggest also that different states and various school districts work out and install their own experimental versions of merit bonuses, again in discussion with the appropriate teachers' union, so that the effectiveness of different approaches could be compared.

The differential bonuses might well be the precursors of across-the-board pay increases. As the salary scales for all teachers rose, the differentials might or might not be narrowed or disappear: my own belief is that we should retain them, basing them on the evidence we can bring together as a basis for judgments of merit.

*c. Federal Assistance in Teacher Compensation

> A study should be commissioned of the possible roles of federal, state and local authorities in funding pay increases or bonuses for teachers on either a temporary or a permanent basis. Federal funding is a sensitive issue for many reasons, but there may be some innovative ideas to be explored. For example, the Federal Government might guarantee interest and amortization payments on short-term or medium-term school bonds issued to help with the immediate cost of increasing teacher salaries

selectively or across-the-board. The guarantee might, of course, be underwritten by the state, or might be issued only on recommendation by the state out of a pool of funds provided by the Federal Government.

d. Selection of Prospective Teachers

Some form of selective admission should be instituted for entry into teacher training programs.

*e. Technology in Teacher Training

The use of technology in teacher training, both pre-service and in-service, should be stepped up. Both TV and computer-based courses should be carefully developed and incorporated into the offerings of teacher training programs. This would allow greater flexibility in the places and times at which good instruction might be made available.

*f. Math-Science Training for Present Teachers

High priority should be given to the training in mathematics and science of people who are now teaching those subjects but who have neither majored nor minored in them. In a time of teacher surpluses in some fields and shortages in others, it is desirable to explore re-training of certified but "surplus" teachers to qualify them to switch into areas such as mathematics or science if their talents and interests are appropriate. The use of technology as suggested in A.1.d. above might be especially useful on an in-service basis for this purpose.

g. Teacher Certification

Teacher certification procedures should be re-examined with the aim of making it as quick and attractive as possible for people with education in mathematics and science at or beyond the baccalaureate level to enter the teaching profession. Again, the use of technology as proposed above could help such teachers in obtaining the credits they need to convert temporary certificates into permanent ones on an in-service basis.

*h. Commission on Precollege Teacher Issues

The Secretary of Education should appoint a study panel with a two-year mandate to explore issues in the selection, training and compensation of teachers. The panel would draw some but not all of its members from the Continuing Policy Commission, which should integrate its findings within its overall suggestions for improvement in precollege education.

2. Programs of Study

*a. Re-examination of Course Content

Some 20 years ago we were in the midst of a vigorous and some would say chaotic rush of government-supported "curriculum reform" projects. The result was a ferment of ideas, some successful innovations and some failures. The failures are cited to point to the "folly" of such efforts. This is most unfortunate, since an accelerating pace of change in the world around us means that we cannot afford static programs of study. A re-examination of curricula in mathematics and science, well led, would be timely now. In defining what students should learn from their school program, it would be especially useful to include people from the business community and other employers (e.g., in government service) as well as the appropriate groups in education and the professional associations.

*b. Technology-Assisted Teaching Programs

A useful development would be further creation and much broader utilization of computer-based programs to teach math and science to high school students. These would be especially helpful in the disturbingly large number of high schools in this country (one-third of the total) that are simply not equipped to offer the science and math courses that are prerequisites for college work in those subjects or in engineering.

*c. Weekend and Summer Programs

In many other countries, productive use is made of weekend and summer programs that supplement and extend what is learned, in school in math and science. These programs incorporate aspects of both classroom activity and summer camp. They give students extra practice in tackling quantitative games, puzzles and formal problems.

In view of the fascination that video/computer games clearly have for students, it is easy to see that entertainment and logical analysis could be combined in intellectually challenging and scientifically accurate games for use in weekend and summer programs at which attendance would be entirely voluntary. The appropriate federal agencies should fund the development of prototypical materials for use in such programs.

3. Schools and Their Procedures

a. State Level - Recognition of Honors Level Work

The present emphasis on setting statewide goals and minimum standards for promotion is, I believe, a healthy one even though the procedures may be some distance from perfection. The problem is that in too many cases the minimum standard becomes the maximum as well, for want of any other. Accordingly, the effort to define and measure minimally successful performance should be paralleled by a comparable activity to define and assess attainment at two higher levels: Honors and High Honors. This should be done at the state level, to give it standing in addition to local school grades.

b. Additional Study Time

Many people point to the fact that in some countries the school year is longer (e.g., 240 days in Japan versus 180 in the U.S.A.) or the school day includes more hours. The possibility of lengthening both is real: in particular, an additional half-hour per day would be desirable, in my opinion, at the high school level. A simpler way to increase "time on task," however, is to assign homework on a regular basis. I believe strongly that doing so would be beneficial. More homework is standard in other countries, in addition to their longer hours in class. It is also the norm in the United States among groups (e.g., Asian-American children) whose cultures favor it. Their academic work, on average, is superior. It is hard to dismiss the idea that there may be a connection.

Homework is of the greatest use if it is self-correcting or the student receives feedback from the teacher. In either case, it increases the teacher's work load. Teacher salaries should be raised commensurately.

c. Criteria for Accreditation

The fact that one-third of our high schools do not offer a full academic program in math and science must be remedied. I suggest that each state require that every public high school expand its offerings to include at least three years of science and four years of mathematics by 1987 and that the accrediting associations include the same criterion. Schools could use technology-based courses (notably TV) to help meet the standard, but there is no substitute for qualified teachers to answer students' questions and help maintain their motivation.

d. Special Schools

We already have a number of schools (e.g., the Bronx High School of Science) that draw gifted students into rigorous academic programs. We should encourage and extend such schools, establishing at least one in every state and, by 1987, one in every city of at least 500,000 people.

e. Help from Business

In over 100 communities or geographic areas there are cooperative efforts between leaders in business and education to improve the schools. There are also "adopt-a-school" programs in which a corporation becomes involved with and assists a particular school on a one-on-one basis. Such compacts are useful in many ways and should be extended. Technology companies have a particular stake in helping schools improve and update their activities in mathematics and the sciences. The assistance can take the form of donating lab equipment, providing summer jobs in relevant professional areas for teachers, consulting on changes that are needed in curricula, lending professional staff members to give lectures on latest developments in their areas, or providing released time for a semester or more to allow technically qualified people to become members of teaching teams in the schools, etc.

There is a national Business Committee for the Arts that serves as a useful catalyst for improvements in that area. A parallel Business Committee for Science and Mathematics could prove equally productive.

*f. Help from Government

Every federal establishment with a significant scientific component should seek to enter into a cooperative arrangement with nearby schools to provide assistance to them where such assistance would be welcomed. This help should include most of the elements cited above under "Help from Business."

4. The Learners

a. Students in School

We need to multiply our efforts to make schooling as exciting and rewarding as possible for students and to make sure they do not make early choices of programs that will foreclose opportunities for them later on. A familiar example is the student who chooses general mathematics rather than algebra in grade 9, reaches grade 12 with only two or three years of math and science, and then decides that he would like to be an engineer.

*1. Talent Identification

I suggest that guidance counselors be provided with current information about employment opportunities in jobs requiring quantitative knowledge and skills and about prospects for the future. They should also be encouraged to watch for students whose grades and test scores in quantitative areas are high and urge those students to elect further courses in mathematics and science.

A special effort should be made to encourage women and minority students to continue in the quantitative subjects, in which they have traditionally been underrepresented. Minority-group school teachers and college admissions officers should be enlisted to work with guidance counselors in this identification process, with assistance from federal funding sources.

*2. Acceleration

The identification and acceleration program (Study of Mathematically Precocious Youth) pioneered at Johns Hopkins University and now spreading widely into other states in the northeast should be encouraged with federal funding, which should be expanded to permit extension of the idea to every part of the country.

*3. Math and Science Scholarships

The Merit Scholarship Program and the newer ARTS Program (comparable awards for accomplishment in the arts) lend prestige to outstanding performance in their respective ways. Special scholarship programs for undergraduate study in mathematics and science, with winners at district, state and national levels, should be given high priority as a way of bringing attention to the importance of those areas of study and prestige to those who have developed their abilities to high levels. Such scholarships could be launched with funding by the Federal Government but continued with support from business, private philanthropy, or a combination of the three sources.

b. People Out of School

It is harder to know how to reach the already adult population to increase the national consciousness of science in our lives.

1. Media Campaign

Good people in the business of communications should be enlisted in the search for ways to use television and other media to bring home to people the essential message of change. The importance of science in our own lives and those of our children can be "sold" like any other attitude if expert opinion-molders are given the job. Public-service TV spots sponsored by a major corporation could be a great help.

*2. Adult Education

There are more people engaged in some form of adult education than in traditional schooling. Courses are given in libraries, YMCAs, community centers of all kinds. These settings offer an opportunity to reach adults through science courses that are well done, interesting and in some cases job-related. TV courses in science and mathematics produced for such part-time students and intellectually curious people of all kinds, with a person well trained in science on hand to answer questions, would add significantly to the content of adult education offerings and possibly reach several million adults.

5. Research

We suffer greatly from a lack of solid information that we need in order to plan and execute a program to upgrade American competencies in mathematics, science and technology.

*a. Patterns of Success

Studies are commissioned periodically to seek out instances of successful school practices and to disseminate the findings broadly with the hope of sparking imitators elsewhere. Such inquiries should be repeated on a regular basis, with funding from the National Institute of Education (NIE), and the results incorporated in the work of the Continuing Policy Commission on Precollege Education.

Experience has shown, however, that merely holding up models to general view does little to stimulate other school systems to change. We need to build in a system of incentives and rewards both for introducing and emulating innovations that prove to be unusually successful. To this end, I would suggest:

1. A national award program, federally funded, in which each of 100 school systems judged by NIE to have introduced the most successful and innovative programs in the country are given a cash prize of $100,000 each to be used as they see fit.

2. A companion program, with federal funding but state administered, for school systems that demonstrated high pupil gains in test scores, subject to verification by the state. These awards would be given for successful implementation of plans for improvement rather than for innovation: the schools involved might simply be applying proven techniques in more vigorous ways under strong leadership. The size of the award should depend on the size of the school district but should be large enough to constitute a meaningful reward for special initiative and effort.

The awards for both innovation and improved practice should be very widely publicized and could become a source of community attention to and pride in some of the positive accomplishments of the schools.

*b. Successes in Other Countries

Good ideas in technology seem to leap international boundaries effortlessly. Good ideas in education that are invented in America are watched closely in other countries. But the United States is remarkably ill-informed about developments elsewhere and seemingly apathetic about those we do happen to discover. There is a lot going on out there.

The Federal Government should institute a continuing program to send American scholars abroad each year to seek out and describe patterns of success that can be evaluated, publicized and in many cases adapted for use in this country. An annual expenditure of $3 million for the purpose would pay for itself many times over, perhaps especially in mathematics and science.

*c. Math-Science Awareness Survey

We need to have a better idea of trends in the awareness of people in this country about developments and issues in mathematics and science. The Federal Government should sponsor a specialized survey, using polling techniques, to monitor the level of the scientific knowledge that people in different population categories have at their command, their awareness of current problems, and their attitudes toward technological advances in the economy (e.g., automation) and in our daily lives. Such surveys would give us a factual basis for knowing where we stand, just as polls on other subjects do. The results would be exceedingly valuable in judging the success of past educational efforts and in planning new information approaches.

*d. Trends Related to Abilities, Careers and Education (TRACE)

Project TRACE is a proposed system for gathering and publishing, on an ongoing basis, information related to trends in the flow of students into and through different programs of higher education. The project would integrate information on sheer numbers, now available from national sources, with useful data on comparative ability levels of students pursuing different courses of study. The ability information would be drawn from various sources, most notably the program files at Educational Testing Service, and aggregated with full protection of individual privacy. The project would also study the subsequent entry of students into different occupations, examining trends in both numbers and ability levels of the entering groups, and would develop projections of future supply and demand for use by both educators and employers, public and private.

G. Conclusion

The array of actions that have been brought forward here and that have been proposed by others is very broad. Four general themes seem important in concluding this review:

1. It would be ironic if, in our search for ways to enhance education in math, science and technology, we should fail to make full use of the present state of the art in those areas. Technology in particular must be part of the solution as well as part of the problem.
2. Many groups have a stake in education. Our search for solutions should involve as many of the parties at interest as possible.
3. We should favor solutions that can readily be built into the system rather than patched onto it.
4. We face a long-term problem calling for long-term solutions but we cannot wait years to take action. We need to start now.

Our problems are formidable but far from insurmountable. This Joint Economic Committee can start a train of events that will have repercussions for decades in all of education as well as in America's economic future.

ADDENDA

to

SCHOOLING FOR THE AGE OF TECHNOLOGY: WHERE DOES AMERICA STAND?

by

WILLIAM W. TURNBULL

EDUCATIONAL TESTING SERVICE

JUNE 15, 1983

Addendum 1 presents fuller information on international comparisons that are summarized briefly in the text of the testimony.

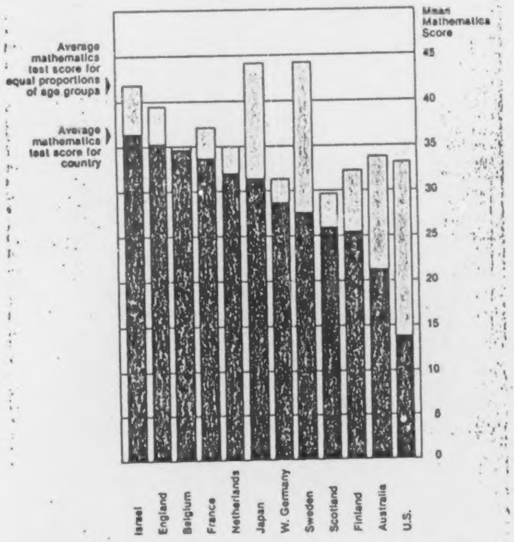
Addendum 2, prepared by the National Council of Teachers of Mathematics, is a fact sheet on the mathematics teacher shortage.

ADDENDUM 1. International Comparisons

Figures 1 and 2 below are drawn from Husén, Torsten. "Are Standards in U.S. Schools Really Lagging Behind Those in Other Countries?" Phi Delta Kappan, March 1983, pp. 455-461.

Illustration by Charmaine Dupena

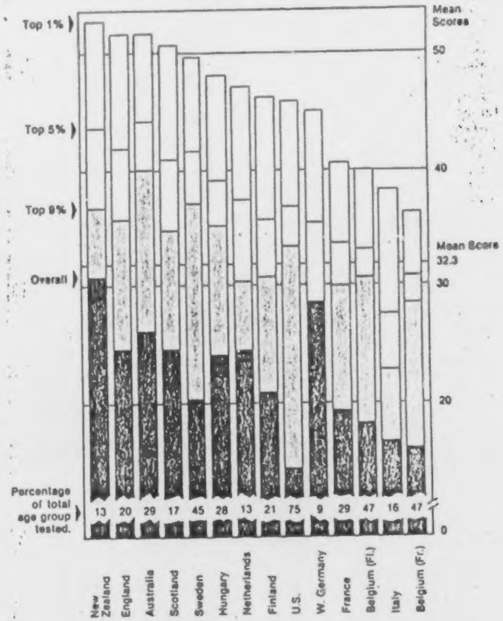
Figure 1. Mean Mathematics Test Scores For Terminal Mathematics Populations in 12 Nations



Source: Torsten Husén, ed., *International Study of Achievement in Mathematics: A Comparison Between Twelve Countries* (New York: Wiley, 1967).

Illustration by Charmaine Dupena

Figure 2. Mean Science Scores of Total Age Group and of Top 1%, Top 5%, and Top 9%



Source: L. C. Comber and John P. Keeves, *Science Education in Nineteen Countries* (Stockholm and New York: Almquist & Wiksell and Wiley-Halsted Press, 1973).

ADDENDUM 2.

NATIONAL COUNCIL OF
Teachers of Mathematics
1906 Association Drive, Reston, Virginia 22091 ■ (703) 620-9840

MATHEMATICS TEACHER SHORTAGE
An NCTM Fact Sheet

National Perspective

1. Mathematics teaching has the severest shortages of any subject area in 1981. (Teacher Supply and Demand 1982, Association of School, College and University Staffing.)

2. Since 1972 there has been a 77 percent decline in the number of secondary-level mathematics teachers prepared in 600 teacher-training programs nationwide. Among newly employed science and mathematics teachers, 50.2 percent were judged by principals to be unqualified to teach in those fields, but had been employed on an emergency basis because school officials could not find qualified teachers. In the Pacific States the ratings of unqualified personnel jumps to 84% by the principals. (Education Week, 31 March 1982.)

3. Only 55% of the graduates prepared to teach mathematics actually entered the teaching profession. Almost five times more science and mathematics teachers left teaching in 1980 for employment in nonteaching jobs than left due to retirement. If the present exodus of qualified science and mathematics teachers from secondary schools continues, the nation will have a net loss of 35% by 1992. The declines in qualified science and mathematics teachers have already exceeded enrollment declines by a factor of three. (Testimony of Sarah E. Klein, President of the National Science Teachers Association, before the Committee on Labor and Human Resources of the United States Senate, 1982.)

4. For fall 1980 the supply of mathematics teachers was only 78% of the demand. (Teacher Supply and Demand in Public Schools, 1980-81, NEA Research Memo.)

5. 43 of the 45 reporting states indicated a shortage or critical shortage of secondary mathematics teachers in 1981. ("National Study of the Estimated Supply and Demand of Secondary Science and Mathematics Teachers" by Trevor G. Howe and Jack A. Gerlovich. Prepared for the High School Chemistry Teacher Conference, Columbia, Missouri, 6 November 1981.)

6. "Alleviating the math-teacher shortage is one of the most immediate and pressing tasks facing colleges and school systems." (U. S. News and World Report, 15 February 1982.)

7. "A shortage of mathematics and science teachers hampers the ability of the schools to provide science and mathematics instruction." (Science & Engineering Education for the 1980's & Beyond, National Science Foundation and Department of Education, October 1980.)

Selected States

1. North Carolina: In 1979-80 only 55% of the mathematics teachers in the state were certified to teach mathematics. (Mathematics Teacher, December 1981.)

2. Missouri: Only about 40 of the 80 prospective mathematics teachers who will graduate from Missouri's teaching institutions are expected to be teaching the following fall, although at least 200 vacancies are expected in the state. (Kansas City Times, 21 May 1982.) There was a 43% increase in the issuance of emergency certification in 1979 vs. 1978. (Mathematics Teacher, March 1981.)

3. New York: The nation's second-most populous state, had only 32 college graduates planning to teach junior or senior high school mathematics in 1982. New Hampshire: Only one college graduate in the state in 1982 is planning on a career in mathematics teaching. (Christian Science Monitor, 12 July 1982.)

4. California: Of the more than 400 000 students in California's public four-year institutions in the spring of 1982, only 97 were preparing to be secondary mathematics teachers. (Phi Delta Kappan, September 1982.)

5. Texas: Only 20 new mathematics teachers graduated in the state in 1982, and only 7 went into teaching. (Mesquite Daily News, 11 May 1982.)

6. Maryland: A survey by the State Department of Education at the end of the 1979-80 school year estimated that 50,000 secondary students received their mathematics instruction from more than 400 teachers who were not certified to teach secondary mathematics. (School, March/April 1981.) In 1982 only 17 new mathematics teachers graduated in the state and 8 went into teaching. (Clarence Miller, Maryland State Department of Education, June 1982.)

7. Connecticut: Last year the state lost 100 mathematics teachers through retirement or job shifts while only 28 mathematics teachers graduated from the 14 state institutions. (Steve Leinwand, Connecticut Department of Education, September 1982.)

8. New Jersey: The State Department of Education has declared an emergency shortage of mathematics teachers in 17 of New Jersey's 21 counties. This emergency designation permits districts to use unlicensed teachers--some without bachelor's degrees--to teach the subject. (Star-Ledger, 13 September 1982.)

9. Iowa: The number of graduates prepared to teach mathematics declined from 234 in 1970 to 60 (-74%) in 1979. The number of vacancies in that period fluctuated between 200 and 250 each year. Shortages are most severe in smaller school districts. (School Science and Mathematics, January 1982.)

10. Mississippi: State Superintendent of Education Charles Holladay reported that state institutions are not even close to providing the 400 to 500 mathematics teachers that will be needed this year. (Jackson Daily News, 9 July 1982.)

Some Solutions

1. Nationally: John Glenn (D-Ohio) and Dave McCurdy (D-Oklahoma) have introduced a "Precollege Mathematics and Science Teacher Assistance Act" which amends the Title IV of the Higher Education Act of 1965 to provide direct loans (7% interest) to college students preparing to be elementary and secondary mathematics and science teachers. Their "Precollege Mathematics and Science Education Act" amends the Internal Revenue Code to allow a credit for high technology employers who hire precollege mathematics and science teachers for the summer. A credit is also provided to firms that allow full-time employees the hours away from work to teach mathematics and science in public schools. (Both bills are being considered by the House Science and Technology Committee, July 1982.)

2. Alabama: Undergraduates who seek mathematics teaching certification are eligible for loans for tuition, books, room and board for each year of full-time study. For each year of teaching experience, one year of the scholarship will be forgiven. Teachers with six hours of mathematics (college algebra or higher level courses) are eligible for a permit to teach vocational and general mathematics at the seventh and eighth grade levels. The certificate is renewable upon entry into a state approved program leading to full certification. (William Berryman, Alabama State Department of Education, July 1982.)

3. Kentucky: Undergraduates who seek mathematics teaching certification are eligible to receive $2500 loans beginning with their sophomore year. A year of the loan will be forgiven for each year of teaching. Certified teachers in other fields who attend summer school to become certified to teach mathematics will qualify for up to one-third of the loan amount. (Lydia Sledge, Kentucky Department of Education, July 1982.)

4. California: 15 million dollars has been set aside for this fiscal year for upgrading skills of mathematics and science teachers in grades K-12 through offerings of 15 regional centers around the state. (Joe Hoffman, California State Department of Education, September 1982.)

5. Houston, Texas: Critical staff stipends for mathematics teachers are $800 a year and may soon be increased to $2000. As part of Project Search, tuition and book costs as well as $250 per course were paid to selected experienced teachers who completed a summer program of four three-hour courses with a grade of B or better. Through this process, teachers were able to earn the 15 credit hours needed for temporary middle school certification then full certification with 18 credit hours. (Mira Baptiste, Houston Independent School District, September 1982.)

6. Oklahoma City, Oklahoma: Certified mathematics teachers new to the system receive a $500 bonus. All certified mathematics teachers are eligible to receive an extra $100 per course taught each year. (Carl Ruble, Oklahoma City Schools, July 1982.)

7. Richmond, Virginia: Certified mathematics teachers who are hired by the Richmond schools receive a $2000 bonus for signing—$1500 for the first year and $500 the second year. Teachers who leave before two years must pay back a portion of the bonus. (Jerry Owens, Richmond Public Schools, August 1982.)

8. Philadelphia, Pennsylvania: Selected teachers will participate in a 3-year program resulting in certification and will be guaranteed jobs teaching mathematics. (Philadelphia Inquirer, 9 February 1982.) Vacancies in the middle and junior high school level are being filled with people who have no background in secondary school mathematics. (Pennsylvania Council of Teachers of Mathematics Newsletter, March 1981.)

9. Dallas, Texas: $500 000 has been allotted for tuition, books and transportation for teachers who wish to upgrade their skills in mathematics and for those who wish to gain certification in mathematics. (Mary Lester, Dallas Public Schools, July 1982.)

10. Fairfax County, Virginia: Teachers who have been in the school system for four years and who wish to earn mathematics teaching certification (27 hours) may enroll in a series of courses through Northern Virginia Community College and a local four-year university. The tuition is paid but teachers must teach in the system for three years after gaining certification or repay tuition costs. (Sylvia Auton, Fairfax County Schools, July 1982.)

11. Palm Beach County, Florida: Teachers not certified to teach middle or junior high school mathematics can gain certification by taking a sequence of three state certified courses. Tuition is free to teachers. (Ruth Bower, Palm Beach County Public Schools, July 1982.)

Senator **Bentsen**. Mr. Turnbull, I will hold questions until we finish. You were talking about innovative steps we can pursue to deal with teacher shortages. So, I want to call on Mr. Billy Reagan next. He heads one of the largest independent school districts in the United States. He is a man who has taken the lead on some innovative and creative things, and taken some very controversial positions, as well. And up to now, he seems to be getting away with it. [Laughter.]

Mr. Reagan, please proceed.

STATEMENT OF BILLY R. REAGAN, GENERAL SUPERINTENDENT, HOUSTON INDEPENDENT SCHOOL DISTRICT, HOUSTON, TEX.

Mr. **Reagan**. Thank you, Senator. Let me say that the picture is, I think, one of a great storm cloud that we are faced with. But because we are here this morning, I have hope that we are going to work through this thing very quickly.

Prefacing my remarks, let me—Senator, I have some exhibits here that I think would be of utmost value to my testimony, if I might provide a copy and there are copies here for members of the press. Also, there are others in this box behind me for those who would like to have them.

Senator **Bentsen**. We would be delighted to have them.

Mr. **Reagan**. Let me give a personal experience to relate to Mr. Turnbull's testimony, particularly as it relates to the Japanese.

I had the opportunity of serving the better part of 4 years of my military service in Japan in the early 1950's, and I followed with a great deal of interest the Nation and its progress. In Houston, we are matched as sister cities with Chiba, Japan. In about the first or second week of May, we had a delegation of ninth graders from Chiba City come to the Houston schools, and naturally, they came by to bring me a plaque from their school superintendent.

The first astonishment I had is when they walked into my office. The young men were as tall or taller than I am. I was totally amazed with the physical growth that has taken place. But in the ensuing hour, as I pursued with those ninth graders their junior high school and soon to be high school programs of preparation, I have no reservation in making the statement that those ninth graders have already had more academic preparation in math and science than 90 percent of the American high school students. And I give that as a personal witness from what I have experienced in the last 30 days in this matter.

Second, to hopefully add emphasis to the situation, "The Nation at Risk," I think, is an excellent document. Many of us have known for many years that the problem existed and there is nothing in it that surprises me in any way, shape, form, or fashion.

If education is the engine that drives the dynamic enterprise of the Nation, then I think that we are at a point of trying to run a turbocharged high compression engine on low-grade kerosene. I think that's exactly what the Nation is faced with. In order to get in to address specifically the questions, Senator, that you have raised, my prepared statement is here and I will reference it with some additional examples.

First, our school system is large. We have 195,000 youngsters; 30,000 of those youngsters do not speak English. I am told by the Department of Education that we have more students in our school system than the States of New Mexico and Arkansas combined. Of the 30,000 who do not speak English, 40 percent of them are on free lunch; 80 percent of our student body is minority. And when we speak of diversity, I don't believe that you can find a situation any more diverse in terms of the makeup of a major city. We have enrolled over 1,000 El Salvadoran children this year already, and that relates back to some of our prior conversations on the undocumented situation. We have in excess of 10,000 undocumented students now.

So we have a very diverse school system. It's a school system that has a 50 percent minority faculty also in terms of its makeup and in dealing with the teaching staff and the elements that are involved. In looking at the students, 20,000 of them have a handicapping condition.

As we looked at this problem back in the 1970's, we tried to come up with the question of why this incredible decline has taken place. We searched and searched for solutions to it. In September, to take a benchmark, September 1, 1978, we had 34 secondary mathematics teacher vacancies and 13 secondary science vacancies.

In other words, each day we had 5,800 students in our schools that were receiving little or no math and science instruction because we had substitutes. Our records show us that we have had many students who graduated from high school who never had a certified math or science teacher under which they could get appropriate instruction.

So, as Mr. Turnbull has laid out the national picture, let me move on to our local situation.

What we did in coming up with a solution or trying to find a solution to the problem, we approached it from four dimensions. The first dimension is that we designed an incentive pay plan. We designed what we call the "Second Mile Plan." It's an incentive pay plan and it is working beautifully.

Second, a district-sponsored teacher retraining program was initiated. The exhibits that I have to show to you today, and Senator, I would plead for the testimony and plead for the committee to look at not only the need to recruit young people and the need to get more teachers, qualified individuals, but I think that the evidence is overwhelming that many of those that we have presently in our schools are not qualified in terms of their ability, their training or retraining or upgrading as it relates to their ability to teach current subject matter. So the retraining element is very important.

We have also developed what we call a "Teaching Partners" program. We find in many communities that there are individuals who have left the education profession to rear family or they have gone to work somewhere else or they decided that they were going to sell real estate. And we find that there are a number of people that would like to come and teach halftime. So we have matched partners together in order to deal with the problem.

And then the fundamental issue that I am sure my two fellow Texans are going to speak a great deal about is the need for an increase in salaries. We have made, I think, outstanding progress in terms of the overall salary picture in order to reward individuals.

If we may look at the Second Mile Plan in detail because I believe that that is the centerpiece of my testimony.

The Second Mile Plan was designed to do just exactly that—it was designed to reward those individuals who would go the second mile in meeting the diverse needs of that student population that I have described to you. We went directly to business. We went to business and asked their support in helping us design an incentive pay plan since business and industry in most every circumstance has incentive pay in their own remuneration programs.

Once we started with the idea, it gained widespread community support. The business community said, we are going to support you. We are even willing to support a tax increase, if necessary.

The plan has four primary thrust—the improvement of instruction and academic achievement is the most important one. That's what the business community said. They are concerned about the other parts they want to see academic growth take place on the part of young people.

The second thrust was to deal with the shortage of teachers. The third was to deal with staff stabilization. What we have in our cities, what we have in Houston, Tex.—each year we go and recruit individuals from all over the United States. They would come to Houston and then we became a recruiting agency for the suburban districts of Harris County. A turnover situation—we could not keep teachers in our inner-city high schools or in our inner-city junior high schools. It is different. It is difficult. The challenges are great. The environment alone creates a special challenge to individuals. So staff stabilization was another objective.

The last thrust was recognition of teaching as a rewarding career.

As we move now in terms of the elements of the plan itself, there are several requirements which must be met. First of all, the plan applies to those individuals who teach 50 percent of the time or more. It is not for counselors, it is not for administrators. So, first of all, you must be teaching 51 percent or more of the day.

Second, you must have a satisfactory evaluation.

Third, you must have, and we borrowed this from the IRS, you must have an average of no more than 5 days absence over 3 years. That, again, is a matter of teacher stability and a matter of absenteeism.

The first category of the plan is high priority location. Teachers at the inner-city schools, some 80 campuses out of the 243 in our most deprived areas, receive a $2,000 stipend. The second is the critical staff shortage in the fields of math, science, special education and bilingual education.

Our beginning salary this year is $16,000. So a beginning math teacher in Yates High School can earn the stipend for critical staff shortage in a high priority location. So that individual's beginning salary this year was $20,000 in terms of the 185-day contractual relationship.

The third component——

Senator **Bentsen**. How would that relate to the rest of the country, or to Texas, for example?

Mr. **Reagan**. In terms of beginning salary?

Senator **Bentsen**. Yes.

Mr. **Reagan**. Harris County probably now is not the top 5 percent in the Nation in beginning salaries. New York City has as a beginning salary this year of around $13,000. Los Angeles is in the $12,000 to $13,000 range. So, considering Harris County or Dallas County, we are probably now in the top 10 percent of the Nation.

Senator **Bentsen**. So, if you would relate that to the cost of living in the different regions, Houston may even be in the top 5 percent.

Mr. **Reagan**. It is different substantially in terms of the rural areas to what the cost of living is in Houston. There's no doubt about it.

The third component of the plan is outstanding teacher attendance. We have a very liberal leave policy—15 days a year for personal business, family illness, and on and on. We found that that program was being used extensively, particularly in the spring when people decided that they were going to leave. In the plan, if a teacher has perfect attendance, we buy back 5 days a year. And, Senator, I can report to you today that we have 97-plus percent attendance of our teachers every day.

Senator **Bentsen**. What does that mean when you say you buy back 5 days a year? You pay them?

Mr. **Reagan**. We pay them $100 a day for 5 days or the 4 days or the 3 or 2 or 1. And we will see the impact of that in just a moment.

Professional growth—we provide a stipend of $300 for those courses taken, such as a new technology, bilingual education, special education, reading, and others that meet our priorities.

And then the center point of the plan is outstanding educational progress. The business community said, we want a goal set on outstanding progress. We have designed a computer model that predicts within very narrow parameters the student academic growth within ability. It takes in all variables of socioeconomic, experience of the faculty, non-English speaking, and so forth. And it has been in operation 3 years and it's a fine system.

So, if this building reaches its predicted growth, those teachers got an $800 stipend on December 18. If they were in the top 10 percent of growth in the school system, they got $1,200.

So, in our example, the beginning math teacher priority location at Yates High School this year got $2,000 for math, plus $2,000 for high-priority location, and got $1,200 for outstanding educational progress because they were in the top 10 percent and that's a total of $5,200 in stipends.

Senator **Bentsen**. $5,200 in bonuses?

Mr. **Reagan**. $5,200 in bonuses. That's correct. Moving now to the results, because it is questioned, has been questioned, has been criticized—I have to give you the factual data.

This document [indicating] that is part of the testimony, you will note that in the first year and moving to the second year and this past year, not the one we just concluded, but last year, we paid $6,800,000 in stipends out of a salary budget of some $180 million. This year we were paying $11 million in stipends out of a salary budget of some $200 million. That gives you a ratio in relationship.

In the high priority location, we paid $2,400,000. In the critical staff, $1,100,000. In the professional growth, $117,000. Outstanding teacher attendance, $1,200,000 in days that we bought back. And outstanding educational progress, $1,900,000.

What has it done in teacher absenteeism? It has reduced it from 9 percent in 1978–79 to this year, it will be somewhere in the neighborhood of 4 or 5 percent overall in terms of average absences.

District turnover. In resignation in 1978–79, we had 11 percent resignations in the school system. That's out of a faculty of 10,600. So we had a thousand teachers resigning every year, the turnover. We reduced it last year to 7.2 and this year it's going to be about 5 percent in terms of resignations, the lowest that we know of of any comparable entity in America.

What did it do in terms of vacancies? We started the 1979–80 school year with 368 vacancies. This year, we started the school year with 62 vacancies. Those were broken down to 40 in elementary, 22 in secondary, and we will look now at the critical staff vacancies, math and science and bilingual.

We had 195 critical staff shortages on September 1, 1979. This year we had 30 vacancies at the beginning of school. We had 2 in math, 1 in science, and 17 in bilingual. So we feel by any criteria of measurement the plan is working beautifully.

We have, due to the inaction of our legislature, quite a few financial problems. We are now going through some retrenchment. We have just done a survey this week of our teachers of whether or not they wanted to eliminate the "Second Mile Plan" as a part of cost containment, and the answer is an overwhelming no, that they would not.

Two final statements. Because of the relationships with our business community—they pay about 70 percent of the taxes in our State and city for the cost of education—we are now launched on a plan of what we call the "Houston Plan for Excellence." The "Houston Plan for Excellence" has substantially addressed the questions that Mr. Turnbull has raised about the matter of standards for promotion, higher standards in academic achievement and graduation requirements.

No youngster next year will get credit in a subject at the senior high school level, Mr. Turnbull, who has not taken the districtwide proficiency exam. We find that from teacher to teacher to teacher, we have a lot of different standards in terms of what youngsters should receive. Students will have to pass the teacher requirements and they will also have to pass the districtwide exam before they will get credit for the course next year.

So we have a student component. We have a parent component. And the staff component. Because of the documentation that is in this instance right here, I can show you over and over that if you look at every school system in America, you will find at the elementary school level, and I believe that they will support me on this, at the elementary school level, the test scores look good. And then we hit the junior and senior high school, and here we go.

Why does that happen? Well, first, you can say that in elementary schools, you got a self-contained classroom and the teachers can be held accountable. That is a valid argument. You can say in the eighth grade, they fall in love and become distracted. That is another valid argument. You can say in the 11th grade that they go to work, and 65 percent of our 11th and 12th graders work, and they become further distracted. That is a valid argument.

But, Senator, what we are finding more and more, and the data is here but time will not permit me to go over it, but what we are finding more and more and it hurts me to have to say this, but the problem must be addressed—many of us in the secondary schools of America today do not possess the basic skills ourselves to teach above the 8th, 9th, and 10th grade level. And our data that is based on research, not emotion, is validating this. As the teacher test scores and as the administrator test scores become available in California, Florida, and in October in Texas, I think that my point will be validated over and over.

So in the Houston plan for excellence, we have committed our school system in the next 3 years to undergo a complete proficiency certification program, every one of us, from the superintendent to the head custodian. We feel that we must go back and retrain ourselves if we are going to meet the needs of these youngsters.

We are proposing a beginning salary schedule, and this is where we hope to turn the whole situation around, and the business community will go with us—we are proposing a beginning salary schedule of $21,000. A teacher with a master's degree and 20 years' experience will earn $38,000 for 185-day service.

So when you add the "Second Mile" stipends on top of that, in 1986–87, we offer the opportunity in our school system for between 2,000 and 3,000 of the 10,000 teachers to be making in excess of $40,000 a year for 185-day service.

Senator **Bentsen**. Mr. Reagan, are you recruiting teachers here today? Is that part of your program? [Laughter.]

Mr. **Reagan**. Yes, sir, very much so.

Senator **Bentsen**. I assume you want to leave your name and address. [Laughter.]

Mr. **Reagan**. And I have the applications. [Laughter.]

The last point. Project Search. There is an adequate supply of elementary teachers. We went to the elementary school and said, how many of you who think you have the math and science aptitude that you would like to move to the junior high, how many of you would like to move to the big leagues? We found 300 individuals who wanted to move. We went through a screening program. Why do they want to move? There is a $2,000 stipend to encourage them to move, and other things.

So we have a training program now of moving the elementary teachers, who have the math and science background, to the secondary level. In addition, we went to the junior high and said, how many of you want to move to the big leagues? You are always talking about, when can I teach in high school. If you're willing to go through a training program, we will move you up.

So with the dimension of the "Second Mile Plan," Project Search, teaching partnerships, and an enhanced salary schedule, we think they are on the way to dealing with the issue.

Senator **Bentsen**. Mr. Reagan, that's a very interesting bit of testimony. Obviously, you have made substantial progress in addressing math and science teacher shortages.

[The prepared statement of Mr. Reagan, together with the attached exhibits, follows:]

Prepared Statement of Billy R. Reagan

MATHEMATICS AND SCIENCE TEACHER SHORTAGE: PROBLEMS AND SOLUTIONS

INTRODUCTION

There were days during the 1978-79 school year when as many as 6,000 secondary students in the Houston Independent School District sat in mathematics or science classes without a certified teacher. On September 1, 1978, there were 47 secondary science and mathematics teacher vacancies in the district. On September 1, 1982, there were two mathematics teacher vacancies and one science teacher vacancy. This dramatic change resulted from specific actions the district, the nation's sixth largest, has taken to address one of education's most critical problems.

It is important to have an understanding of the circumstances which were the impetus for the district's actions. In the second half of the 70's, the Houston Independent School District was facing many of the problems common to urban school districts across this nation. Approximately one-third of all public school children are in urban districts which are responsible for educating a mobile population with large numbers of children who are economically and educationally disadvantaged, bilingual, or from one-parent families or families in which both parents are employed. The Houston Independent School District provides an example. Approximately 195,000 children, or one-tenth of all children enrolled in public schools in Texas, are enrolled in the Houston Independent School District this current school year. The student body is 43 percent black, 32 percent Hispanic, and 22 percent white, with a growing number of children who are Asian/Pacific Islanders. Approximately 6,000 pupils are children of undocumented workers. This year 29,000 children have been identified through testing as having Limited English Proficiency (LEP). While the majority of those have Spanish as the other language, 96 discrete dialects have been identified. Compensatory education programs serve over 50,000 children and approximately 100,000 are eligible for either free or reduced cost lunches. There are 20,000 handicapped children in programs of special education. Of all pupils, 70 percent have neither parent at home during the day and 38 percent come from single-parent homes. The mobility rate for the district as a whole is 39 percent, and some inner-city elementary schools have a 99 percent mobility rate. A major school-operated transportation system carries students to the 240 campuses scattered throughout the 311 square miles that comprise the district. An operating budget of approximately $500 million is approved for the current school year.

To all of these complex factors, add the problems of sheer size, the difficulties of moving about in a large city without an adequate mass transportation system, the media's continuing portrayal of urban schools as places of violence, and the discrepancy between teachers' salaries and salaries offered by business and industry in a metropolitan center dominated by finance and the petrochemical industry. These are the factors which contributed to the increasing difficulty the Houston Independent School District was having in 1978-79 in filling science and mathematics teaching positions, especially in the inner-city schools where high staff turnover was common.

THE PROBLEM

On September 1, 1978, there were 34 secondary mathematics teacher vacancies and 13 secondary science teacher vacancies in the Houston Independent School

District. With each teacher scheduled to teach five classes a day, this means that a total of 235 classes of mathematics and science, each with an average of 25 students for a total of at least 5,875 students, did not have a certified instructor. Investigation has shown that there are probably large numbers of students who graduated from some large high schools having received nearly all of their secondary science or mathematics instruction from substitute teachers.

The national problem has been well documented most recently in the report from the National Commission on Excellence in Education.

- Mathematics and science teachers are in short supply.
- Colleges and high schools are raising their standards which include the addition of more credits in mathematics/science, increasing the need for teachers in these critical areas.
- Technology related jobs requiring mathematics/science proficiency are the wave of the future.
- Other nations are emphasizing the quality and quantity of mathematics/science education at all levels.

The supply of competent mathematics and science teachers is low and declining. In the past ten years there has been a 77 percent decline in the number of mathematics teachers and a 64 percent decline in the number of science teachers in the nation. The teacher training institutions that traditionally produced sufficient numbers of classroom teachers to provide a steady supply of quality instruction are themselves lacking in eligible candidates.

Adding to the demand for mathematics and science teachers is the trend of higher standards for high school graduation and college admission. To reach our goal of educational excellence, the Houston District has increased the number of mathematics and science courses required for graduation of all students and has initiated a requirement of computer literacy for all students. Meeting these higher requirements will necessitate finding even more teachers in the critical fields. Without these teachers to instruct our students, there is little hope that they can fill the technology related positions in the job market of the near future. At stake also is our ability to compete with the technological sophistication of students around the world.

The teacher crisis is before us on a nationwide basis. It consists of a dramatic shortage of teachers in critical fields such as mathematics, science and special education. It is high teacher turnover in urban schools resulting in detrimental instability in urban classrooms. It is placing before our students, teachers who themselves cannot read, write and compute in an acceptable manner. It is high absenteeism and low morale. It is a complex conglomeration of factors which has resulted in widespread wavering from traditional standards of excellence. At a time in the history of civilization when the demand for learning beats greater than ever before, the ability of the public schools to perform the task has been seriously jeopardized.

HOUSTON INDEPENDENT SCHOOL DISTRICT'S RESPONSE TO THE PROBLEM

The district's responses to the problem have been several and some are a dramatic departure from solutions traditionally espoused in public education:

- an incentive pay plan
- a district sponsored teacher retraining program
- a part-time teacher/teaching partners program
- an increase in the base salary to attract new teachers

Incentive Pay

By borrowing the concept from business and industry, we initiated a plan whereby teachers in the critical fields are given financial incentives which both attract and hold qualified persons. Our incentive pay plan has met with success. Vacancies in the critical areas have been reduced dramatically. While the teacher unions are married to the lock step salary schedule and espouse the principle of equal pay for equal work, the fact remains that the law of supply and demand impacts even education. If a similar situation existed in business, the solution would not be to raise salaries for all employee of the business, but rather the amount paid a particular job to attract personnel in the shortage area.

Widespread community support was expressed when the Board of Education adopted the Second Mile Plan, an incentive pay plan for teachers, effective in September of 1979. The plan, an expression of determination to address offensively the teacher crisis, was hammered out without benefit of precedent or example, for while the concept of incentive pay for teachers has long been debated in education circles, it has never been comprehensively worked out and implemented until now.

The Second Mile Plan targets four specific areas:

a. Improvement of instruction and academic achievement

b. Shortage of teachers

c. Staff stabilization

d. Recognition of teaching as a rewarding career.

The purpose of the plan is to reward those teachers who go beyond the minimum required to meet the instructional needs of their students, teachers who go "The Second Mile." The plan provides financial incentives over and above their normal salary to teachers who teach in curriculum areas or campus locations where critical shortages exist.

Teachers must meet certain minimum requirements to establish eligibility for stipends and then must apply for each stipend. An employee may qualify for a bonus stipend in each of six categories which are consistent with the four main target areas the plan was designed to address. The Plan is detailed in full in the attached Exhibit A.

Predictably, reactions to the Second Mile Plan have been varied. As noted, the business community has supported both the concept and the expenditure of several million dollars each year to implement the incentive pay plan. The three teacher organizations representing Houston teachers have opposed the plan, arguing that funds spent for the plan should be used to provide across-the-board raises or fringe benefits for all teachers. But more than half of the district's teachers responded to a district survey that the plan should be continued. Those who received stipends rated the plan more favorably than those who did not.

After three years of operation, many positive results of the plan are evident. In the four critical areas for which stipends are paid, total beginning of the year vacancies decreased from 195 in 1979 to 30 in 1982. During the years from 1978-79 to 1981-82, total district teacher turnover for all reasons was reduced by 6.8 percent. Absences of teachers in the critical staff areas were reduced from an average of 10.3 days in 1978-79 a year to 7.0 days in 1981-82. Over $17 million in stipends has been paid to teachers during this three-year period, with many eligible teachers augmenting their salaries by more than $3,000 per year. Chapter I funds are used for a portion of the high priority location stipends; all other stipends are paid from local funds.

The district continues to monitor the results of the Second Mile Plan and to modify the plan to meet changing local needs. There is ample evidence that financial rewards to teachers through a carefully administered incentive pay plan can help meet one of education's major crises.

District-Sponsored Retraining of Teachers

A second approach to alleviating the teacher supply problem is a teacher retraining program. Project Search, begun in 1980-81, is a local school district staff retraining program, operated in conjunction with local universities, which identifies and recruits already employed teachers into training programs leading to certification in mathematics and science. Elementary level teachers with some college credits in mathematics or science and interest in teaching one of these subjects at middle/junior high school level were put into an intensive tuition-paid program this past summer. Likewise middle/junior high school teachers were recruited for training programs leading to certification for high school science or mathematics.

The district not only paid for college tuition and books, but also paid these teachers a $250 per course stipend as well. The $250 stipend was contingent upon an A or B grade. Teachers in the program signed agreements to remain in the district for three years in mathematics or science positions or else to repay the district the cost of their training.

Over 300 teachers came to an orientation meeting designed to recruit 50 teachers for retraining as mathematics teachers. Careful screening for good academic records, good evaluations and good recommendations from principals followed.

At the end of the first training cycle this summer, 34 teachers were placed in new assignments as mathematics or science teachers. In spite of careful screening, some applicants could not maintain the required all A and B grades and were counseled out of the program. Two participants have moved from the district.

Part-Time Teacher/Teaching Partner Program

Another way to reduce the shortage in critical areas might be through a part-time teacher program. Especially in large metropolitan areas there may exist a reservoir of persons who have the time, skills and desire to participate in a teaching career on a part-time basis. Because of the period structure in the secondary schools, part-time teachers could easily be assigned to teach two, three, or four periods a day. Contributions on a part-time basis would help to alleviate the problem (Exhibit B).

Increase Teacher Salaries

To increase teacher salaries, Houston plans two steps. First, beginning salaries must be increasd in order to attract the best students into teaching.

Houston raised the starting pay for first-year teachers in 1982-83 to $16,000 - a 14.2 percent increase over the previous year. The second step to be taken is compression of the salary schedule from the current 18 steps to 11 steps by 1986-87. By 1986-87, the starting salary is scheduled to be $21,000 with only ten years of experience required to qualify for a salary of $30,000 (see Exhibit C).

These are the major actions taken by the Houston Independent School District to address the shortage and quality of teachers. A determination to address the whole issue of the image of the teaching profession, the number and quality of students being recruited into the profession and the quality of the teaching-learning process permeates the district and is expressed in many other ways.

1. Standards for promotion and graduation have been raised;
2. a comprehensive staff assessment and assistance program is underway which includes proficiency testing;
3. technology is being used to support the instructional process;
4. plans are proceeding for the opening of two magnet high school programs for the teaching profession; and
5. piloting of a year-round school program which has the main benefit of increased time-on-task for students, but also offers teachers year-round employment opportunity and the opportunity of increasing their salaries by 30 percent.

Another Dimension

A yet untapped resource is the use of technology as a teaching tool. One of the greatest areas of promise is the microcomputer in delivering individualized instruction. While the microcomputer cannot replace a qualified mathematics or science teacher, it can provide another dimension in the education process. While the hardware is available and being purchased in great volume in schools across the nation, a crucial element has yet to be addressed -- the development of quality software.

Basically we find that districts all across the country are facing the same set of software problems with little resolution in sight. These problems include:

- Stiff pricing structures that require schools to purchase one copy of a program for each user with no free "back up" copies.
- Reluctance on the part of software vendors to lease their programs on a quantity-sale basis.
- Few computer programs available except in key areas such as reading/language arts and mathematics. Most other curriculum areas are ignored because of their small profit potential.
- Refusal of publishers to make their programs available on a computer network which would allow schools to reduce their hardware costs.

The problem is delineated more fully in the attached Exhibit D.

We would urge the formation of a national consortium to develop quality software for the public schools.

SUMMARY

The Houston Independent School District will continue to take whatever actions are necessary to assure that its students have qualified teachers in all subject areas. We will support legislation that:

(1) recognizes the dignity and worth of teachers;

(2) addresses improvement of mathematical and scientific literacy for the general population and the development of high level skills among the most talented;

(3) builds on state and local initiative;

(4) supports both good programs already in operation and new programs aimed at reform among others;

(5) recognizes the need to fund software production for our nation's schools.

EXHIBIT A, PART 1

THE SECOND
MILE PLAN

of the
HOUSTON INDEPENDENT SCHOOL DISTRICT

APRIL
1983

THE SECOND MILE PLAN

AN INCENTIVE PAY PLAN
for
TEACHERS
of
THE HOUSTON INDEPENDENT SCHOOL DISTRICT

BOARD of EDUCATION

Mrs. Marquis L. (Blue) Alexander, Jr., President
Ms. Augustina (Tina) Reyes, Vice President
Mr. Ray A. Morrison, Secretary
Mrs. Elizabeth Spates, Assistant Secretary

Mr. Wiley E. Henry
Mrs. Bobby Ann Peiffer
Dr. James C. Jones
Mrs. Cathy H. Mincberg
Mr. Tarrant Fendley

ADMINISTRATION

Dr. Billy R. Reagan, General Superintendent
Mr. Joseph T. Angle, Superintendent for Area Administration
Mrs. Patricia M. Shell, Superintendent for Instruction

1982-83

H8-69.1

TABLE OF CONTENTS

Page

THE NEED 3

Improvement of Instruction 4

Staff Stabilization 4

Teacher Shortage 5

Recognition of Teaching as a Rewarding Career 6

THE PLAN 6

What Is the Incentive? 7

Who May Participate? 7

What Are the Six Categories That Qualify for Incentive Pay? 7

When Are Stipends Paid? 8

What Should a Teacher Do To Participate? 9

SUMMARY OF EVALUATION 9

HISD BOARD POLICY 12

HISD ADMINISTRATIVE PROCEDURES 13

Application Process 14

Baseline Requirements 14

Stipend Payment 15

Appeals Committee 15

Requirements ahd Amounts of Stipend for Specific Components 16

EXAMPLES OF APPLICATION OF SECOND MILE PLAN 22

EXAMPLES OF ABSENCE AVERAGING 25

THE NEED

Of the many crises facing public urban education today, the least heralded has been the teacher crisis. Yet despite its lack of notoriety the teacher crisis hails as the single most critical issue facing urban education today.

Why? Our students are coming to school today with a heightened complexity of needs that must be addressed by the schools. These are needs that were either neglected before or assigned to some other institution of society before or new needs as a result of our changing world. These are the needs created by multiple handicaps, both physical and mental; the needs created by language barriers, both dialectical and ethnic; the needs created by dramatically changing home environments, both an increase in the number of working mothers and in the proportion of one-parent families; and the needs created by technological and economic changes in the work place.

So at a time when the needs of our students are greater than ever before, the need for teachers with multiple skills and understandings is greater than ever before. Yet, the public schools are faced with a critical teacher crisis.

What is the teacher crisis? The teacher crisis is a dramatic shortage of teachers in critical fields such as mathematics, science and special education. It is high teacher turnover in urban schools resulting in detrimental instability in urban classrooms. It is placing before our students, teachers who themselves cannot read, write, and compute in an acceptable manner. It is high absenteeism and low morale. It is a complex conglomeration of factors which has resulted in widespread wavering from traditional standards of excellence. At a time in the history of civilization when the demand for learning beats greater than ever before, the ability of the public schools to perform the task has been seriously jeopardized.

In recognition of this reality, the Houston Independent School District determined that the time had come to act, to move beyond traditional lock step salary schedules and allocate resources in such a way as to force changes that could help solve the problems. After great deliberation it was decided that a revolutionary plan was needed to address offensively the teacher crisis. Thus the Second Mile Plan was born: an incentive pay plan for teachers.

Once the commitment was made to the philosophy of incentive pay, the enormous task remained of hammering out a workable plan without benefit of precedent or example, for though the concept has been debated in education circles from coast to coast, it has never been comprehensively worked out or implemented until now.

Careful consideration had to be given to delineating those areas which could realistically be addressed by an incentive pay plan. After all was said and done, four basic target areas were identified as follows:

H8-69.3

a. Improvement of instruction

b. Staff stabilization of urban schools

c. Shortage of teachers

d. Recognition of teaching as a rewarding career

IMPROVEMENT OF INSTRUCTION

Certainly a priority of any education program is the improvement of instruction, and the Second Mile Plan is no different. However, in Houston it was felt that instructional improvement needed to be addressed in two ways.

First, it was believed essential to reward teachers for the educational progress made in recent years. Standardized test scores in HISD had been on the increase for three consecutive years after several years of continuous decline. By 1978-79, HISD fourth graders had joined students in lower HISD grades in achieving at or above national norms. Comprehensive analyses of various achievement measures prepared by the school district and submitted to the Federal District Court in sworn testimony indicated clearly that HISD students consistently outperformed their counterparts in the county, in the state, and across the nation. The analyses were based on comparisons by stratified socio-economic levels of students.

Moreover, teachers had rallied to the various causes of the seventies including desegregation of faculties and student bodies, implementation of educational and social programs for students by state and federal mandate, and voluminous increase in accompanying paper work. The outstanding results of successful magnet school programs had revealed the value of highly motivated teachers and extended programs.

Yes, it was time to reward teachers for their efforts.

STAFF STABILIZATION

Certainly, one of the critical aspects of urban education in the seventies was the instability, especially in inner city schools, created by staff absenteeism and excessive teacher turnover. These factors cannot help but subtract from the kind of stable, supportive, nourishing environment necessary for learning to happen.

(So essential was staff stability considered to be that a massive staff stabilization plan was developed and implemented in the Houston Independent School District. In fact, the Second Mile Plan is one component of the total staff stabilization effort, but it is through that component that teachers may receive the financial incentive to teach in critical locations.)

While it was never thought that financial reward could offset undesirable working conditions, it was nevertheless true that teacher turnover in some schools was far greater than in other schools. Incentive pay for teachers who would choose to remain in those critical high-turnover locations was therefore considered to be one of several viable alternatives for addressing the problem.

Employee absenteeism, while disturbing the continuity of the educational process, assumes massive proportion when coupled with the severe shortage of substitute teachers existent in the District over the last few years. In the 1978-79 school year it was common to receive 200 more requests for substitutes daily than could be filled. Therefore, incentive pay for good attendance, it was hoped, would help to alleviate the problem of absenteeism.

TEACHER SHORTAGE

The third dilemma that the Second Mile Plan was designed to address was the burgeoning dilemma of the teacher shortage--shortage in quantity of teachers available for jobs and decline in quality of those entering the profession.

For a number of years, the Houston school district had opened school in September with several hundred classrooms unmanned by certified teachers. Areas of critical shortage included mathematics, science, bilingual and special education, and certain vocational and technical fields. On any given day in 1978-79, some 6,000 Houston students sat in mathematics classes without certified teachers before them.

Something had to be done! It was decided that the District would commandeer its resources, allocating them in such a way as to force change. Borrowing from the basic principles of free enterprise, money would be allocated to pay stipends to those teachers who could and would teach in the areas of acute need. While differentiated pay scales for teachers have long been anathema to organized teacher unions, it was felt that to make no fiscal effort to put teachers in those empty classrooms would place the leadership of the District in a position of serious liability for the educational needs of the students neglected.

Continuing analyses of the education job market and work force indicate that dramatically declining numbers of American youth are choosing to enter teacher education programs in colleges and universities. Reports from colleges of education show that enrollments in teacher-training programs have dropped by as much as one-half to two-thirds in some cases over the last decade. A job preference survey of HISD high school seniors conducted in the spring of 1978 indicated that only two percent of the graduates that spring would choose teaching as a career.

Unfortunately, school personnel offices can be further disheartened by the fact that the quality of entrants into teacher training programs is on the decline as well. Studies indicate that schools of education are now selecting potential educators from among the least academically talented populations applying for college admission. One study indicated that the average SAT verbal and math scores of college-bound high school seniors who planned to major in education were well below average for all college-bound seniors tested in 1976 (34 points below average on verbal scores and 43 points below average on math scores).

While the reasons for these declines are varied, it must be noted that expanding job opportunities outside the field of education--especially for gifted women whose ranks have long provided the bulk for the teaching force--have robbed the nation's classrooms of their teachers.

Therefore, it was hoped that incentive pay would provide the incentive needed to attract more and better applicants back into the teaching profession.

RECOGNITION OF TEACHING AS A REWARDING CAREER

Once attracted into or back into the profession, teachers must look upon the career of teaching as rewarding if they are to remain in the field--rewarding both emotionally and financially. The Second Mile Plan was developed to address the financial portion of that need.

Heretofore, career advancement has moved the teacher farther and farther from direct daily contact with children. Through the Second Mile Plan, it is hoped that good teachers can receive the financial incentive necessary to remain in the classroom.

Such financial incentives should address the following:

1. Enabling teachers to make a fulltime commitment to the teaching career. Until now, many teachers have had to hold additional jobs if they could hope to support themselves at an acceptable standard of living. Frequently, bread winners have been unable to afford the luxury of a teaching career. Through the incentives available under The Second Mile Plan, teaching becomes a realistic career choice for all.

2. Encouraging participation in professional growth activities. While enrollments have declined, demand for learning has vastly expanded. Teachers must be encouraged to return to school to update knowledge and obtain advanced certification and degrees. The ability to do this is further complicated if a person must moonlight to provide necessities for his or her family. The Second Mile Plan addresses this problem by providing incentive pay for professional growth activities.

THE PLAN

The Second Mile Plan as described in this section provides for payment of incentives to teachers for fulfilling certain instructional commitments identified by the Board of Education as critical to the needs of students. Every effort has been made to make the plan objective in its application; little or no subjective judgment is employed as a criterion. Specific guidelines and details for implementation follow. This section is only a brief overview.

WHAT IS THE INCENTIVE?

The incentive is the payment to a teacher of a stipend over and above his or her regular salary.

WHO MAY PARTICIPATE?

An HISD teacher who meets the baseline requirements listed below may participate in the plan. To be eligible for participation, the teacher must:

- hold a valid teaching certificate or permit appropriate to the teaching assignment
- be assigned to a school or instructional site
- be paid on Pay Grades 7, 8 or teacher with doctorate
- have no score below "3" on the most recent post-assessment for teachers assessed in 1982-83 (Scores on Pre-Professional Skills Test will not be used in 1982-83 ratings.)
- have a score of 3.0 or better on the most recent post-assessment for teachers assessed prior to 1982-83
- have five (5) or fewer days of absence during the current school year or have an average of five (5) days or fewer of absence during the time period that includes the current year and two previous years (see examples beginning on page 25)
- have no unexcused absences
- be a full-time teacher, nurse, learning resources specialist (librarian) or be a part-time teacher whose only assignment is as a part-time teacher.

WHAT ARE THE SIX CATEGORIES THAT QUALIFY FOR INCENTIVE PAY?

- High Priority Location of teaching assignment - refers to schools with a concentration of educationally disadvantaged students. Stipends are $2,000 in a high priority location.
- Critical Staff Shortage - refers to teaching assignments in secondary science, secondary mathematics, bilingual education and special education. Stipends are:

  Mathematics - $2,000
  Science - - - $2,000
  Special Education - $700 - $1,000
  Bilingual - - - - - -- - - - $2,000

- Outstanding Teacher Attendance - refers to attendance that exceeds baseline requirements. Stipends range from $500 - $50 based on 0-5 days of absence. Absence averaging cannot be used to qualify for this stipend.
- Professional Growth - refers to successful (grade of "B" or better) completion of college courses in curriculum and instruction appropriate to the current teaching assignment or district inservice. Also, teachers who return to college to acquire certification in areas where critical teacher shortages exist are eligible for a stipend. Coursework completed in the area of reading also qualifies for a stipend. Courses in educational administration, counseling, guidance and general education do not qualify.

For each 36 hours of approved district inservice, the stipend is $150. For each 6-hours of university coursework the stipend is $300 and if the courses are in an area where critical teacher shortages exist, the stipend is $400. Any course where tuition is paid through an HISD program will not count toward the stipend.

- Outstanding Educational Progress - teachers assigned to schools where the school average for student's rate of academic gain as measured by standardized tests is greater than the mathematically predicted school achievement goal may be eligible for a stipend. If the school average qualifies, each eligible teacher assigned to the school will receive the stipend. For an individual teacher on a qualifying campus to be eligible for this stipend, he/she must meet the baseline requirements stated earlier. Teachers at schools which exceed their predicted target will be eligible for the O.E.P. stipend ($800). Teachers at the top 10% of the elementary schools, junior/middle schools, and senior/special schools which exceed their target score by the greatest amount will receive an additional $400.

- Unique Campus Assignment - teachers who teach at a campus for which no test data are available, either because the students are not at the school long enough to be tested or because the students are not able to be tested using standardized tests, may receive the Unique Campus Assignment stipend. These teachers are not eligible for Outstanding Educational Progress stipend. These school sites are subject to annual review.

  Teachers assigned to one of the following sites will be eligible for the 1982-83 stipend provided they satisfy baseline requirements:

  - Grady Special School - $750
  - T. H. Rogers (Handicapped Component) - $750
  - Thomas Care Center - $750
  - Contemporary Occupational Training Center - $450
  - Harris County Youth Village - $450
  - Harper Learning Skills Center - $450
  - Gulf Coast Trades Center - $450

WHEN ARE STIPENDS PAID?

Three components, Critical Staff Shortage, High Priority Location, and Unique Campus Assignment are paid in June. However, if a teacher leaves the district or is promoted during the year a prorated portion of these three stipends will be paid provided he/she has met the baseline requirements. If a teacher loses eligibility during the school year through failure to meet baseline requirements, the stipend will not be prorated.

H8-69.8

Teacher Attendance, Outstanding Educational Progress, and Professional Growth stipends are paid in the fall of the school year following the school year for which they are earned. Fall stipend payments are contingent upon a teacher's return to the district. The O.E.P. stipend payment is contingent upon a teacher's return to the O.E.P. campus. The only exception is for teachers who retire or who are involuntarily transferred.

WHAT SHOULD A TEACHER DO TO PARTICIPATE?

To participate in the Second Mile Plan the teacher must first know that he or she meets the baseline requirements for participation and is eligible under one or more of the six categories that qualify for incentive pay. Then the teacher must apply in writing to the principal for one or more of the Second Mile stipends. Applications will be made available in the schools and must be completed and submitted within specified time periods.

SUMMARY OF EVALUATION

Several positive impacts of the Second Mile Plan were noted. While offering teachers the opportunity to increase their salaries by as much as $5,000, the plan also has positive impacts on reducing teacher absenteeism and faculty turnover, reducing the number of teacher vacancies, and increasing student achievement. An evaluation of the Second Mile Plan by the Research, Evaluation, and Accreditation Department revealed the following impacts:

1. The percent of teachers who resigned, took a leave, retired, or transferred to another campus decreased 6.8% from the 1978-79 to 1981-82 school year.

2. The number of teacher vacancies at the beginning of the school year decreased from 613 in August 1979 to 221 in August 1982.

3. Vacancies in critical staff shortage areas decreased from 251 in August 1979 to 87 in August 1982.

4. The median percent turnover in high priority schools decreased from 3.5% to 1.5% from 1979 to 1980.

5. The average number of teacher absences decreased from 9.0 absences in 1978-79 to 7.4 absences in 1981-82.

6. In the first three years of implementation, a total of $17.9 million has been paid in Second Mile stipends.

7. Approximately 51% of teachers surveyed in January 1981 agreed that the Second Mile Plan should be continued, 12% had no opinion, 33% disagreed, and 4% did not respond to the question.

H8-69.9

8. At all elementary grade levels, the average academic achievement of students at grades 1-6 met or exceeded the expected grade placement.

9. In 1980-81, there were 11,601 fewer substitute teachers used than in 1979-80 for a savings of $464,040 (11,601 days x $40) in substitute teacher pay.

H8-69.10

HISD BOARD POLICY
AND PROCEDURES

551.147 Second Mile Plan Stipends

The Second Mile Plan shall be designed to address: (a) improvement of instruction; (b) recognition of teaching as a rewarding career; (c) staff stabilization; (d) shortage of teachers; and (e) attendance.

Administrative procedures shall provide for the eligibility requirements, stipend amounts, process of application, method of payment, and appeals process. The Stipends Desk of the Payroll Department shall monitor and validate for payment all stipend requests. It shall be the function of this office to devise and disseminate accurate record keeping procedures for line and staff sign-off on Second Mile Plan. Additionally, the Stipends Desk shall be responsible for calling the Appeals Committee meetings and informing appellants of the outcome.

The following categories of stipends shall be paid in accordance with corresponding Administrative Procedures.

(a) High Priority Location
(b) Critical Staff Shortages
(c) Unique Campus Assignment
(d) Professional Growth
(e) Outstanding Teacher Attendance
(f) Outstanding Educational Progress

All aspects of the Second Mile plan shall be subject to annual review as part of the budgetary process. Stipends shall be paid at specified payment periods depending on the type of stipend. Stipends for High Priority Location, Critical Staff, and Unique Campus Assignment shall be paid in one lump sum in June of the school year for which they are earned. However, if a teacher leaves the district or is promoted during the year, a prorated portion of these three stipends will be paid provided he/she has met the baseline requirements. Stipends for Professional Growth, Outstanding Educational Progress, and Outstanding Teacher Attendance shall be paid in the fall of the year following the school year for which they are earned. Fall stipend payments shall be contingent upon a teacher's return to the district. Payment for O.E.P. stipends is contingent upon a teacher's return to the O.E.P. campus. The only exception will be for teachers who retire from the district or who are involuntarily transferred.

The Second Mile Plan shall be voluntary. Teachers who are eligible and desire to participate in the Second Mile Plan must make application within the fiscal school year. No retroactive payments will be made if a teacher fails to apply within the stated timelines.

H8-69.13

551.147 Second Mile Plan Stipends

The Second Mile Stipends shall be administered by the Stipends Desk of the Payroll Department in accordance with the following requirements:

a. Application Process

(1) The teacher applies in writing to the principal for one or more of the Second Mile Plan stipends.

(2) The principal validates the teacher's compliance with baseline requirements and forwards the application to the area office. In the event that the application is denied, the principal must state on the application the reason for the denial and return the application to the teacher.

(3) The Area Office validates all necessary data pertaining to Personnel Sevices (certification, assignment, etc.). In the event the application is denied, the Area Office must state on the application the reasons for denial and return the original application to the teacher. The applicant may appeal to the Second Mile Appeals Committee. The Area Office will maintain documentation and will forward the original of all approved applications to the Stipends Desk.

(4) The Stipends Desk will make payment at designated pay periods to eligible applicants.

b. Baseline Requirements

A teacher may be eligible for and receive more than one stipend. However, in order to be eligible for any Second Mile stipend, the teacher must satisfy each of the following baseline requirements. The teacher must:

(1) hold a valid teaching certificate or permit, appropriate to the teaching assignment

(2) be assigned to a school or instructional site

(3) be paid on pay grades 7, 8, or teacher with doctorate

(4) have no score below "3" on the most recent post-assessment for teachers assessed in 1982-83 (Scores on the Pre-Professional Skills Test will not be used in 1982-83 ratings.)

(5) have a score of 3.0 or better on the most recent post-assessment for teachers assessed prior to 1982-83.

(6) have five (5) or fewer days of absence during the current school year, or have an average of five (5) or fewer days of absence during the period that includes the current year and two previous years. Days absent without loss of time as provided in:

Section 553.212, Professional Leave;
Section 594.300(b), Grievance Hearing;
Section 572.820, Teacher protection from attack/assaults;
Section 553.211 d, funeral leave; e, court appearance; f, jury duty; g, military leave

shall not be included in this total. The number of allowed absences will be prorated based on days of active service (see Chart A).

(7) have no unexcused absences. Unexcused absences shall include approved short leave requests for which salary deductions are made.

(8) be a full-time classroom teacher or a part-time teacher whose only assignment is as a part-time teacher. This shall include and be limited to classroom teachers, nurses, and learning resources specialists.

A full-time teacher is defined as one who teaches a minimum of 5 out of 7 periods or 4 out of 6 periods per day. Department chairpersons are considered full-time.

CHART A
Prorated Absences Based on Days of Active Service

Number of Active Days of Service	Allowable Personal Leave Absence
0 - 16	0
17 - 33	0.5
34 - 50	1.0
51 - 67	1.5
68 - 84	2.0
85 - 101	2.5
102 - 118	3.0
119 - 135	3.5
136 - 152	4.0
153 - 169	4.5
170 - 185	5.0

c. Stipend Payment

(1) The plan is voluntary and payments are not made automatically. Teachers must apply in writing to the principal for one or more of the stipends.

(2) All stipend payments shall be made in one lump sum in June or in the fall of the subsequent school year depending on the specifications of the stipend.

(3) A teacher who resigns, retires, takes a leave of absence, or is promoted during the year will be eligible for a prorated stipend payment. If a person has met the baseline requirements, the stipend will be prorated based on the number of days of active service. (See Chart A for calculation of allowable absences.)

(4) If a teacher loses eligibility during the school year through failure to meet baseline requirements, the stipend will not be prorated.

(5) The O.E.P. stipend payment is contingent upon a teacher's return to the O.E.P. campus.

d. Appeals Committee

A Second Mile Plan Appeals Committee, whose members shall be designated by the General Superintendent, shall review all appeals submitted concerning the Second Mile Plan. The head of the Stipends Office shall be the chairperson of the committee. It shall be the chairperson's responsibility to call meetings and send notification to teachers concerning the outcome of their appeal.

The appeals process shall operate as follows:

(1) If an application for a stipend is denied at the campus level and if the teacher feels he/she has a valid reason for appeal, he/she may attach to the original application a letter describing the reasons and forward it to the area office. The principal shall indicate on the application the reason for the denial.

(2) The area office will review and forward valid appeals to the chairperson of the Appeals Committee in the Stipends Office.

(3) The chairperson will call a meeting of the committee to review appeals.

(4) The decision of the committee will be communicated in writing to the teacher.

e. Requirements and Amounts of Stipend for Specific Components

If a teacher has met all baseline requirements, the following requirements shall be applicable for each specific stipend:

(1) High Priority Location

High Priority Location refers to schools with a concentration of educationally disadvantaged students participating in Chapter I and/or the Focus on Academic Achievement (FOAA) Program. The schools identified as high priority locations are subject to change each year. The 1982-83 campuses are listed below:

Elementary Schools

Almeda
Atherton
Bastian
Berry
Blackshear
Bowie
Brock
Bruce
Burnet
Burrus
Carnegie
Chatham
Clinton Park
Concord
Crawford
Crockett
DeZavala
Dodson
Dogan
Douglass
Easter
Eighth Avenue
Eliot
Fairchild
Foster
Gregory-Lincoln
Harper
Harris, J. R.
Henderson, N. Q.
Holden
Houston Gardens
Isaacs
Jones, Anson
Jones, J. W.
Jefferson
Kashmere Gardens
Lamar
Langston
Lantrip
Law
Lee
Looscan
McDade
Milam
Pleasants
Port Houston
Pugh
Reynolds
Rhoads
Roosevelt
Ross
Rusk
Ryan
Sanderson
Scott
Scroggins
Sherman
Stevenson
Sunny Side
Tijerina
Turner
Wesley
Whidby

Secondary Schools
Attucks Jr.
Fleming Jr.
Key Jr.
Marshall Middle
McReynolds Middle
Smith Middle
Terrell Middle
Woodson Middle
Davis Senior
Kashmere Senior
Wheatley Senior
Worthing Senior

Teachers in High Priority Location assignments shall receive $2,000.

(2) Critical Staff Shortages

Teachers who teach in areas of critical shortage may receive the Critical Staff Shortage stipend. However, areas of critical shortage are to be analyzed annually and reidentified as needed. Therefore, an area that qualifies as a critical shortage area one year may not qualify the next.

Teachers assigned in these critical instructional areas will be eligible for the Second Mile stipends provided they satisfy baseline requirements:

(a) secondary science - $2,000

(b) secondary mathematics - $2,000

(c) bilingual in a bilingual assignment that requires bilingual certification - $2,000

(d) special education -

- special education teachers and vocational teachers of the handicapped (VEH teachers) - $700

- special education teachers of the severely profoundly handicapped - $1,000
(The SPH designation is for those teachers whose students meet State criteria or have three or more major handicaps; e.g., blind, orthopedic, retarded. More than half [51 percent] of the students in a class must meet the state criteria for severely profoundly handicapped; or more than half [51 percent] of the students in a class must each have three or more major handicaps - e. g., blind and orthopedic and retarded.)

This stipend will be paid in June of the year it is earned provided all eligibility requirements have been met.

(3) Unique Campus Assignment

Teachers who teach at a campus for which no test data are available, either because the students are not at the school long enough to be tested or because the students are not able to be tested using standardized tests, may receive the Unique Campus Assignment stipend. These teachers are not eligible for Outstanding Educational Progess stipend. These school sites are subject to annual review.

Teachers assigned to one of the following sites will be eligible for the stipend provided they satisfy baseline requirements:

. Grady Special School	$750
. Thomas Care Center	$750
. T. H. Rogers (Handicapped Component)	$750
. Contemporary Occupational Training Center	$450
. Harris County Youth Village	$450
. Harper Learning Skills Center	$450
. Gulf Coast Trades Center	$450

This stipend will be paid in June of the year it is earned provided all eligibility requirements have been met.

(4) Professional Growth

Instructional personnel who successfuly complete courses which have been approved by a committee in the Staff Development Department and which are related to teaching assignment or a critical teaching shortage area will be eligible for stipends. Applications for course approval must be filed in the Staff Development Department prior to taking the course.

No more than nine (9) hours of university courses may be completed during the fall and spring semester. No limit will be placed on the hours taken during summer sessions.

Courses above a bachelor's, master's, or doctoral degree must be in the following areas to qualify:

- related to present teaching assignment (curriculum and instructional)
- related to critical need area
- courses in reading
- courses in classroom management

Courses in general educational administration, counseling, and guidance do not qualify. Teacher participation must be completed with a grade of "B" or better from an accredited college or university. In competency based programs, the teacher must demonstrate competency. Inservice activities conducted during the regular school day may not be considered for payment under the Second Mile Plan. Additionally, any courses where tuition is paid through an HISD program will not count toward the stipend.

This stipend is neither cumulative nor retroactive. Hours may not be carried over from one school year to the next.

At the time of application for the stipend an official university or college transcript or grade report must accompany the request for payment. Both approval forms and transcripts should be sent to the Director of Staff Development for processing. Approved applications will be forwarded to the Stipends Desk for payment.

Stipend amounts shall be as follows:

$300 for each six hours of approved credit courses

$400 for each six hours of approved credit courses in a critical teacher shortage area

$300 for one 3-hour university course plus 36 hours of approved inservice attendance

$150 for 36 hours of approved inservice attendance

$400 for each 6 hours for any courses listed on a certification plan signed by a university official for certification in an identified critical staff shortage area.

This stipend will be paid in October of the school year following the school year it is earned and payment is contingent upon a teacher's return to the district.

(5) Outstanding Teacher Attendance

While an attendance factor is included as one of the baseline requirements under the Second Mile Plan, special stipends may be paid to teachers who meet or exceed requirements or are absent five or fewer days during the year. The teacher must work in the district during the following year to receive this stipend. The exchange of unused sick leave days for a stipend is strictly optional. The days affected apply only to locally allocated leave days provided through Board Policy. This dimension does not apply to leave days allocated by State mandate. Therefore, teachers will be able to accumulate unused State days even if they elect to trade in local days.

Attendance shall be computed with the first official day of employment. All teachers employed prior to October 1 will be eligible for this stipend. Absence averaging does not count toward the Outstanding Teacher Attendance stipend.

Stipends will be calculated as follows:

Number of Absences	Amount
0	$500 in exchange for 5 unused leave days*
1	$400 in exchange for 4 unused leave days*
2	$300 in exchange for 3 unused leave days*
3	$200 in exchange for 2 unused leave days*
4	$100 in exchange for 1 unused leave day*
5	$ 50

*Leave days must have been accumulated in current year

This stipend is neither cumulative nor retroactive. Days from one year may not be traded in during another school year. The stipend will be paid in October of the school year following the school year it is earned and payment is contingent upon a teacher's return to the district in a Second Mile Plan eligible position, except for teachers who retire.

(6) Outstanding Educational Progress

Instructional personnel assigned to schools where the school average for student's rate of academic gain as measured by standardized tests is greater than the predicted score for the school shall be eligible for this component. Individuals must meet baseline requirements. The amount of the stipend will be determined annually based on the availability of funds.

This stipend shall be $800 for 1982-83 school year.

This stipend will be paid in December of the school year following the school year it is earned and payment is contingent upon a teacher's return to the eligible campus the subsequent school year. The only exceptions are retirees and involuntary transfers.

All instructional personnel of the school who meet baseline requirements shall be eligible. Personnel who serve more than one school shall be eligible for a portion of the stipend based upon the assignment of service at the school (e.g., two days-2/5; 3 days-3/5, etc.)

Eligibility for each school will be calculated in the following manner:

(a) A data file will be constructed with the following factors for each campus:

- free and reduced lunch rate
- mobility rate
- proportion of LESA students
- proportion of special education students (not self contained)
- proportion of student transfers (by types)
- teacher turnover rate
- previous achievement data

(b) A regression equation will be used to calculate the target score a school would have to achieve in order to meet its goal.

(c) Teachers at schools which exceed their predicted target and who have met the baseline requirements will be eligible for the $800 O.E.P. stipend.

(d) Teachers at the top 10% of the elementary schools, junior/middle schools, and senior/special schools which exceed their target score by the greatest amount and who have met baseline requirements will receive an additional $400.

EXAMPLES OF APPLICATION
OF THE SECOND MILE PLAN

The examples below illustrate how teachers receive extra compensation in various components of the Second Mile Plan. Assumed in each example is that all baseline requirements have been met; i.e., attendance, certification, remaining in assignment, acceptable assessments and so forth. Base salaries are based on the approved salary schedule for the 1982-83 school year.

Example One

Dimension	STIPEND PAID	
	Spring 1983	Fall 1983
Outstanding Educational Progress	$ 0	$ 800
High Priority Location	2,000	0
Critical Shortage	2,000	0
Professional Growth (6 hours)	0	400
Attendance	0	500
Unique Campus Assignments	0	0
GRAND TOTALS	$4,000	$1,700

1982-1983 (BASE SALARY $ 22,360 PLUS STIPENDS): $ 28,060

Mr. Allistar Henry is a science teacher at a high priority location. He has perfect attendance. He will have completed 6 hours of approved graduate credit in science during the 1982-83 school year. Teachers in his school will earn outstanding educational progress stipends based on 1982-83 test data. Mr. Henry is currently on pay grade 8 (Master's degree), step 10 of the salary schedule for 1982-83. These stipends increase his salary by 25.5%.

H8-69.23

Example Two

Dimension	STIPEND PAID	
	Spring 1983	Fall 1983
Outstanding Educational Progress	$ 0	$ 800
High Priority Location	2,000	0
Critical Shortage	0	0
Professional Growth	0	150
Attendance	0	300
Unique Campus Assignments	0	0

GRAND TOTALS $2,000 $1,250

1982-1983 (BASE SALARY $ 17,750 PLUS STIPENDS): $ 21,000

Bill Watson teaches in a high priority location. He has taken 36 hours of District-sponsored inservice during the 1982-83 school year. He has been absent only 2 days and has an acceptable assessment. His school has qualified for the outstanding educational progress stipend during the 1982-83 school year. Mr. Watson is at step 6, pay grade 7 (Bachelor's degree). These stipends increase his salary by 18.3%.

H8-69.25

Example Three

Dimension	STIPEND PAID	
	Spring 1983	Fall 1983
Outstanding Educational Progress	$ 0	$ 0
High Priority Location	0	0
Critical Shortage	1,000	0
Professional Growth (0 hours)	0	0
Attendance	0	300
Unique Campus Assignments	750	0
GRAND TOTALS	$1,750	$ 300

1982-1983 (BASE SALARY $ 19,180 PLUS STIPENDS): $ 21,230

Francis Kelly is certified to teach and is teaching severely/profoundly handicapped students. She teaches at a Unique Campus Assignment location. She has only missed 2 (excused) days for the entire year. Ms. Kelly is on step 6, pay grade 8 (Master's degree) of the salary schedule. These stipends increase her salary by 10.7%.

H8-69.26

EXAMPLES OF ABSENCE AVERAGING

EXAMPLE A

Teacher A was absent 7 days in 1982-83, however, her absences in the two previous years were:

1981-82	4 absences
1980-81	2 absences

Taking the total number of days absent over the three years and dividing by three would yield the average number of absences. If the average is 5 or less, Teacher A meets the attendance baseline requirement.

7 + 4 + 2 = 13 days absence in 3 years
13 days ÷ 3 years = 4.33 average absences per year

With an average of 4.33 absences, Teacher A would meet the attendance baseline requirement.

EXAMPLE B

Teacher B was absent 6 days in 1982-83, and it was her second year in HISD. She was absent 1 day in 1981-82. In this example the average absences are computed as follows:

6 + 1 = 7 days absence in 2 years
7 days ÷ 2 years = 3.5 average absences per year

With an average of 3.5 absences, Teacher B would meet the attendance baseline requirement because the average is less than 5.

EXAMPLE C

Teacher C was absent 9 days in 1982-83. His previous years absences were:

1981-82	3 absences
1980-81	5 absences

The computation of the average yields:

9 + 3 + 5 = 17 days absence in 3 years
17 days ÷ 3 years = 5.66 average absences per year

Teacher C has an average of 5.66 absences per year and, therefore, would not meet the attendance baseline requirement.

HB-69.27

EXAMLE D

Teacher D was absent 6 days in 1982-83. His previous absences were:

1981-82	3 absences
1980-81	3 absences

However, in 1980-81, Teacher D began working for the District on October 20 and, therefore, was allowed only 4 absences for the Second Mile Plan based on his date of assignment. To compute the average number of allowed absences another step in the computation is necessary:

5 absences allowed in 1982-83
5 absences allowed in 1981-82
4 absences allowed in 1980-81
14 ÷ 3 years = 4.66 days of absence allowed
for absence averaging instead
of 5.0 days

Computation of average absences is as follows:

6 + 3 + 3 = 12 days absence in 3 years
12 days ÷ 3 years = 4.0 average absences per year

Teacher D has an average of 4.0 absences per year which is less than his 4.66 allowable days, therefore, he meets the attendance baseline requirement.

H8-69.28

EXHIBIT A, Part 2

TABLE I

SECOND MILE PLAN STIPENDS PAID
1979-80, 1980-81, and 1981-82 SCHOOL YEARS

STIPEND	DATE PAID	NUMBER OF STIPENDS PAID	TOTAL AMOUNT PAID ($)	STIPEND RANGE ($)
FIRST YEAR				
High Priority Location	December, 1979	2,140	720,697	200-500 per semester
	June, 1980	1,780	597,020	200-500 per semester
		3,920	1,317,717	
Critical Staff Shortage	December, 1979	2,095	670,998	100-450 per semester
	June, 1980	1,741	580,105	100-450 per semester
		3,836	1,251,103	
Extended Time	As earned	810	327,107	100-500
Outstanding Teacher Attendance	October, 1980	3,169	1,007,600	50-500
Professional Growth	October, 1980	420	170,600	300-800
Outstanding Educational Progress	December, 1980	3,235	2,478,336	800
Teacher Recruitment	December, 1980	6	3,200	400-600
	TOTAL (1979-80)	15,396*	$6,551,163	
SECOND YEAR				
High Priority Location	June, 1981	1,268	437,994	200-500
Critical Staff Shortage	June, 1981	1,200	894,806	400-900
Outstanding Teacher Attendance	October, 1981	3,457	1,111,000	50-500
Professional Growth	October, 1981	332	145,200	300-800
Outstanding Educational Progress	December, 1981	2,387	1,909,600	800
Teacher Recruitment	December, 1981	15	7,200	400-600
	TOTAL (1980-81)	8,658*	$4,505,800	

TABLE I SECOND MILE PLAN STIPENDS PAID (CONTINUED)

STIPEND	DATE PAID	NUMBER OF STIPENDS PAID	TOTAL AMOUNT PAID ($)	STIPEND RANGE ($)
THIRD YEAR				
High Priority Location	June, 1982	1,341	$2,425,735	$300-$750
Critical Staff Shortage	October, 1982	1,464	$1,139,168	$600-$1,000
Unique Campus Assignment	June, 1982	90	$ 53,073	$450-$750
Professional Growth	October, 1982	263	$ 117,300	$300-$800
Outstanding Teacher Attendance	October, 1982	3,916	$1,217,250	$50-$500
Outstanding Educational Progress	December, 1982	2,454	$1,900,400	$800-$1,200
	TOTAL (1981-82)	9,528*	$6,852,926	

*Represents number of stipend payments, not number of personnel receiving a stipend.

ES:phd #216-23

TABLE II

TEACHER ABSENCES (DAYS)

COMPARISON OF 1978-79 THROUGH 1981-82 SCHOOL YEARS

GROUP	1978-79 AVERAGE ABSENCES	1979-80 AVERAGE ABSENCES	1980-81 AVERAGE ABSENCES	1981-82 AVERAGE ABSENCES
Elementary Teachers	9.2	7.5	7.8	-
Secondary Teachers	8.5	7.7	7.6	-
Nurses	10.1	9.1	8.3	-
Critical Shortage Teachers*	10.3	8.0	7.1	-
Total Teachers	9.0	7.7	7.6	7.4

*Includes bilingual, math, science, and special education teachers

ES:phd #216-24

TABLE III

TOTAL DISTRICT TEACHER TURNOVER

1978-79 TO 1981-82

REASON	1978-79	1979-80	1980-81	1981-82
Resignation	10.6%	9.5%	10.1%	7.2%
Leave	3.2%	2.7%	2.5%	2.2%
Retirement	1.7%	0.9%	2.2%	1.3%
Transfer	8.2%	8.1%*	5.6%**	6.3%
TOTAL	23.9%	21.3%	20.6%	17.1%

*Teachers who transferred to staff new campuses (Clifton, Revere, Welch and Holland) are not included in this figure.

**Teachers who transferred from campuses where the grade configuration was changed from K-6 to K-5 or from 7-9 to 6-8 are not included in this figure.

ES:phd #216-25

TABLE IV

BEGINING OF YEAR VACANCIES

1979-80 TO 1982-83

	August 1				September 1				October 1			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
Elementary	191	47	138	87	140	29	82	40	123	70	86	55
Secondary	164	68	137	134	99	47	78	22	58	19	52	31
Special Fields*	258	90	101	-	129	49	55	-	132	56	49	-
TOTALS	613 (5.6%)	205 (1.9%)	376 (3.4%)	221 (2.0%)	368 (3.4%)	125 (1.2%)	215 (1.9%)	62 (0.5%)	313 (2.8%)	145 (1.4%)	187 (1.7%)	86 (0.8%)

TOTAL TEACHERS	1979	1980	1981	1982
	10,836	10,621	10,959	10,871

*Includes librarians, vocational teachers, nurses, music teachers, and special education teachers

ES:phd #216-26

TABLE V

CRITICAL STAFF VACANCIES

1979-80 TO 1982-83

	August 1				September 1				October 1			
	1979	1980	1981	1982	1979	1980	1981	1982	1979	1980	1981	1982
Bilingual	47	11	61	27	61	7	54	17	50	20**	46.5	16
Mathematics	36	15	41	22	23	12	30	2	14	5	21	4***
Science	28	14	21	7	22	3	16	1	15	2	7	6***
Special Education	140	47	63	31	89	20	31	10	107	35	33	4
TOTALS	251	87	186	87	195	42	131	30	186	62	107.5	30

*There was a decrease in number of positions from 1979-80 to 1980-81 from 1,087 to 1,012.

**Increase in the number of Hispanic children caused need for more bilingual teachers from September to October.

***Receipt of FOAA funding caused need for additional mathematics and science teachers.

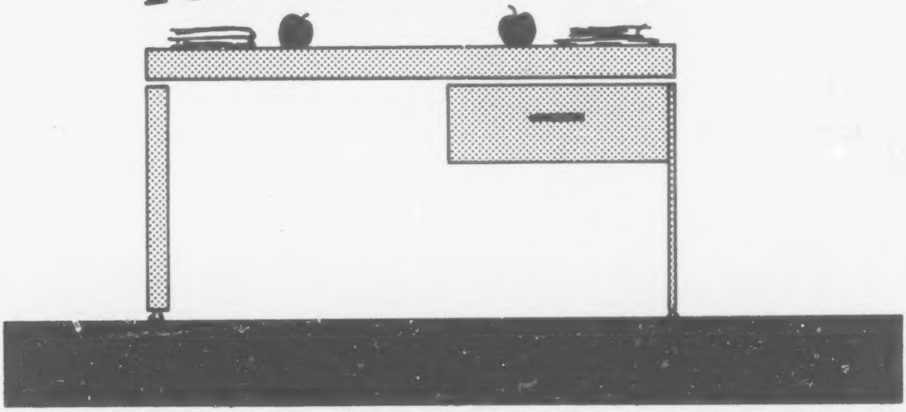
ES:phd #216-27

EXHIBIT B

Teaching Partners

HOUSTON INDEPENDENT SCHOOL DISTRICT

a PART-TIME Teaching Program



Teaching Partners Benefit The School, Students And The Individual

Newspaper headlines continually warn of teacher shortages. In the Houston Independent School District, we are fortunate to have one of the finest teaching faculties of any public or private school in the country. However, the Houston Independent School District is still in need of qualified teachers in certain subject areas, including math and science, bilingual education, and other disciplines on the secondary level as well as kindergarten teachers, nurses, librarians and other specialty areas at the elementary level.

Being a teaching partner/part-time teacher in the Houston Independent School District will benefit both the school district and the part-time teacher.

HISD realizes that there is a reservoir of persons in the school community who have the time, talent and desire to participate in a teaching career on a part-time basis. These include former teachers with young children, retired teachers and graduate students and other members of the community. At the elementary level, many teaching positions including kindergarten positions, and ancillary staff positions such as music, nursing, physical education and other positions could be easily adapted to a part-time basis. Because of the period structure in the secondary schools, part-time teachers would be assigned to teach two, three or four periods a day. Contributions on a part-time basis would help to alleviate the critical shortages in certain teaching fields, including math, science and bilingual education.

Many Persons Are Eligible To Become Teaching Partners/Part-Time Personnel

Persons who meet, or who are potentially eligible for TEA certification and are hired through the HISD selection process would be eligible for employment. The district will advise teaching partner applicants about certification requirements for specific jobs.

Teaching Partners Work In A Variety Of Classroom/School Settings

The Teaching Partner/Part-Time employee can work in a variety of classroom and school settings.

One the elementary level, part-time professional employees would work in half-day kindergarten assignments or as support positions such as nurse, music, art librarian or physical education teacher. Bilingual teachers may also work on a part-time basis.

On the secondary level, part-time teachers could work in any of the disciplines, including math, science, English/language arts, social studies or government. Support personnel could also work on the secondary level.

Teaching Partners Are Eligible For Salary And Benefits Of A Regular Teacher

Teaching partners will be paid based on the number of days or periods that the teacher works. For example, ancillary personnel may work two, three or four days a week. The salary for this type of employee would be calculated and prorated appropriately.

For those working on the secondary level, the percent of time for which a teacher is salaried will be calculated based on the number of periods that the teacher teaches. The total number of teaching periods will be used to determine the percent.

Teaching partners who work at least 50 percent of the year will be eligible for enrollment in the HISD health insurance plan. They will also participate in the Teacher Retirement System program for HISD employees.

Teacher Partners Will Receive A Teacher Contract

Teacher Partners will be given a teacher contract. However, part-time teachers are a separate category for the purposes of reduction in staff. They will earn a salary increment provided they have worked at least 50 percent for the 170 days in one contract year.

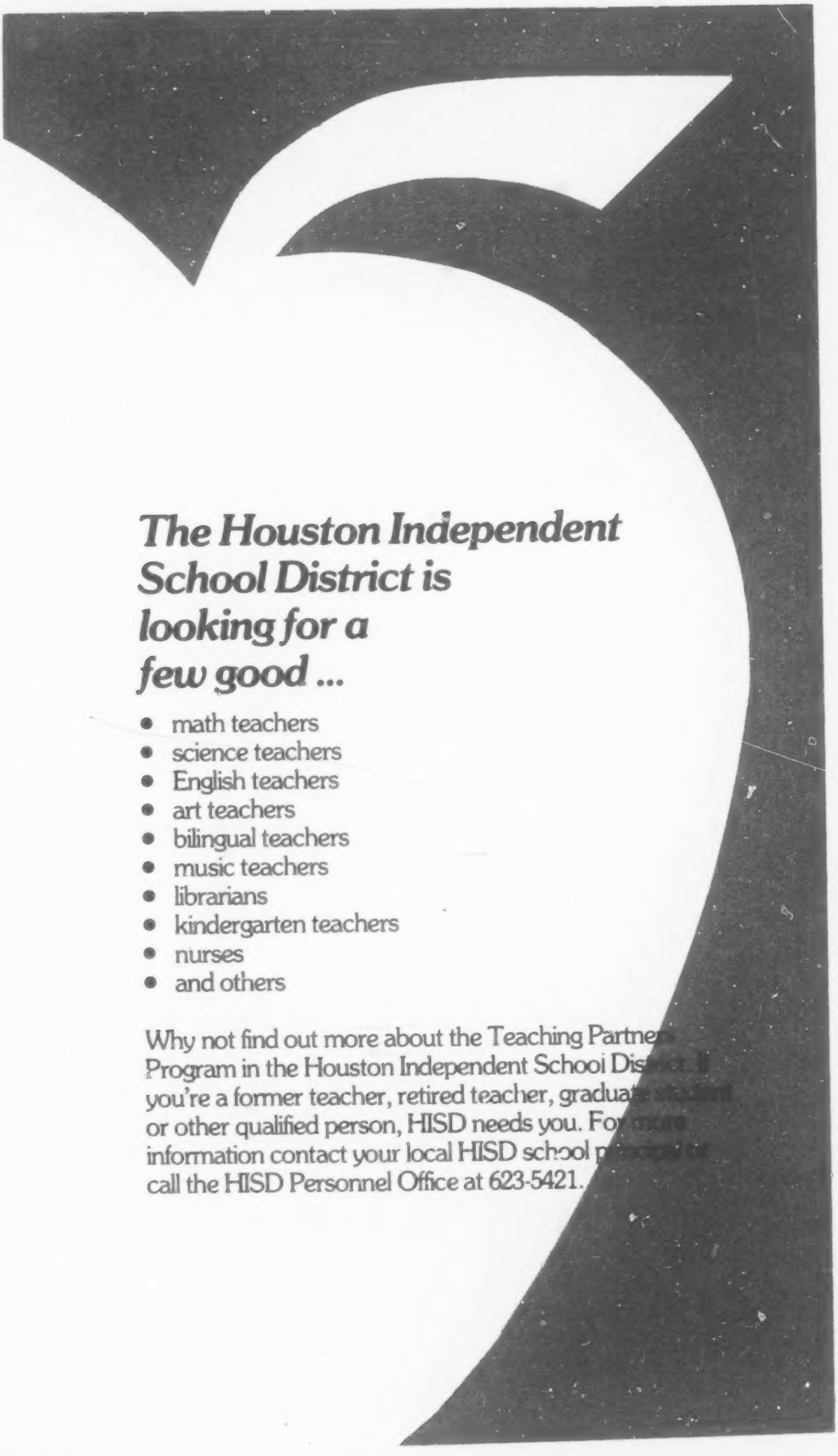
Teaching Partners Will Also Benefit The Individual

In addition to having the opportunity to utilize their talents that best fit their individual needs, teacher partners will be eligible for

- the Second Mile Plan/teacher incentive pay plan (on a prorated basis)
- tax sheltered annuity programs
- deferred compensation plan

All It Takes Is A Phone Call Or Note To Find Out More

Anyone interested in finding out more about the HISD Teaching Partners Program should call the HISD Personnel Office at 623-5421. Those who would like an application, can write the HISD Personnel Office, 3830 Richmond Avenue, Houston, Texas 77027, attention Teaching Partners Program.



The Houston Independent School District is looking for a few good ...

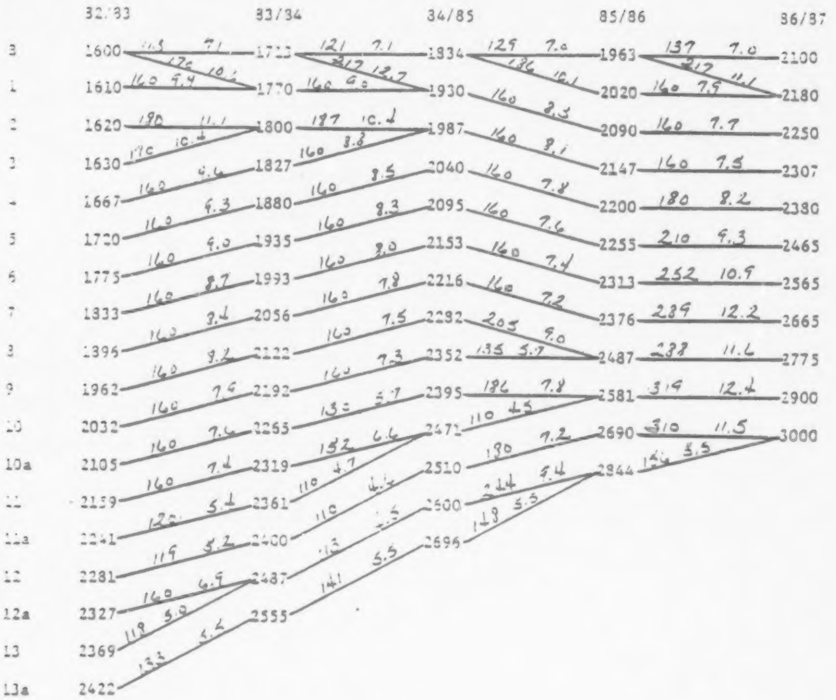
- math teachers
- science teachers
- English teachers
- art teachers
- bilingual teachers
- music teachers
- librarians
- kindergarten teachers
- nurses
- and others

Why not find out more about the Teaching Partners Program in the Houston Independent School District. If you're a former teacher, retired teacher, graduate student or other qualified person, HISD needs you. For more information contact your local HISD school principal or call the HISD Personnel Office at 623-5421.

EXHIBIT C

HOUSTON PLAN

HISD Pay Grade 7, Bachelor's Degree


82/83
83/84
84/85
85/86
86/87
B 1600 113 7.1 1713 121 7.1 1834 129 7.0 1963 137 7.0 2100
170 10.6 217 12.7 186 10.1 217 11.1
1 1610 160 9.9 1770 160 9.0 1930 160 8.3 2020 160 7.9 2180
2 1620 180 11.1 1800 187 10.4 1987 160 8.1 2090 160 7.7 2250
170 10.4 160 8.8
3 1630 160 9.6 1827 160 8.5 2040 160 7.8 2147 160 7.5 2307
4 1667 160 9.3 1880 160 8.3 2095 160 7.6 2200 180 8.2 2380
5 1720 160 9.0 1935 160 8.0 2153 160 7.4 2255 210 9.3 2465
6 1775 160 8.7 1993 160 7.8 2216 160 7.2 2313 252 10.9 2565
7 1833 160 8.4 2056 160 7.5 2282 205 9.0 2376 289 12.2 2665
8 1896 160 8.2 2122 160 7.3 2352 135 5.7 2487 288 11.6 2775
9 1962 160 7.9 2192 130 5.7 2395 186 7.8 2581 319 12.4 2900
10 2032 160 7.6 2265 152 6.6 2471 110 4.5 2690 310 11.5 3000
10a 2105 160 7.4 2319 110 4.7 2510 180 7.2 2844 156 5.5
11 2159 120 5.4 2361 110 4.6 2600 244 9.4
11a 2241 119 5.2 2400 113 4.5 2696 148 5.5
12 2281 160 6.9 2487 141 5.5
12a 2327 118 5.0 2555
13 2369 133 5.4
13a 2422

ANNUAL LONGEVITY STIPENDS

Years	$	Years	$	Years	$	Years	$	Years	$
		14	400	13-14	300	12-14	250	11-14	200
13-19	400	15-19	500	15-19	500	15-19	500	15-19	500
20+	600	20+	700	20+	800	20+	1000	20+	1500

HOUSTON PLAN

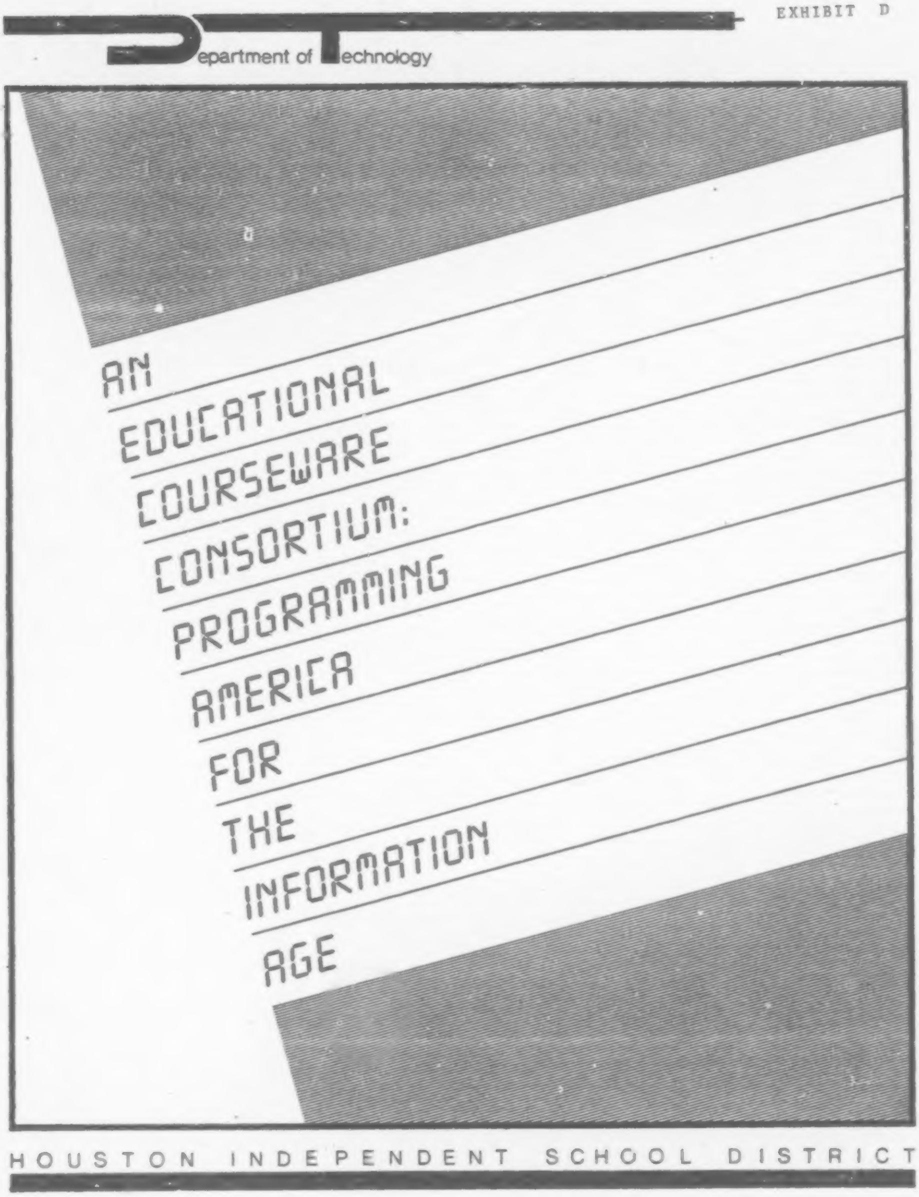
HISD Pay Grade 8 , Master's Degree

	82/83		83/84		84/85		85/86		86/87
B	1630	140 8.6 200 12.9	1770	152 8.6 220 12.4	1922	165 8.6 228 11.9	2087	178 8.5 223 10.7	2265
1	1650	180 10.9	1830	160 8.7	1990	160 8.6	2150	160 7.4	2310
2	1670	160 9.6	1885	160 8.5	2045	160 7.8	2205	160 7.3	2365
3	1725	160 9.3	1947	160 8.2	2107	160 7.6	2267	160 7.1	2427
4	1787	160 9.0	2011	160 8.0	2171	160 7.4	2331	160 6.9	2491
5	1851	160 8.6	2078	160 7.7	2238	160 7.1	2398	226 9.4	2624
6	1918	160 8.3	2153	160 7.4	2313	160 6.9	2473	151 6.1	2764
7	1993	160 8.0	2228	160 7.2	2388	160 6.7	2548	216 8.5	2911
8	2068	160 7.7	2311	160 6.9	2471	135 5.5	2606	158 6.1	3066
9	2151	160 7.4	2396	130 5.4	2526	135 5.3	2661	250 9.4	3229
10	2236	160 7.2	2489	130 5.2	2619	135 5.1	2754	312 11.3	3400
10a	2329	160 6.9	2547	100 3.9	2647	263 9.9	2910	319 11.0	
11	2427	120 4.9	2610	100 3.8	2710	200 7.4	3242	158 4.9	
11a	2510	100 4.0	2659	249 9.4	2908	334 11.5			
12	2559	100 3.9	2696	212 7.9	3091	151 4.9			
12a	2616	80 3.1	2848	243 8.5					
13	2665	183 6.9	2948	143 4.9					
13a	2748	200 7.3							
14	2810	138 4.9							

ANNUAL LONGEVITY STIPENDS

Years	$	Years	$	Years	$	Years	$	Years	$
		14	400	13-14	300	12-14	250	11-14	200
15-19	400	15-19	600	15-19	600	15-19	600	15-19	600
20+	600	20+	800	20+	1000	20+	2000	20+	4000

EXHIBIT D



Department of Technology

AN EDUCATIONAL COURSEWARE CONSORTIUM: PROGRAMMING AMERICA FOR THE INFORMATION AGE

HOUSTON INDEPENDENT SCHOOL DISTRICT

DRAFT

HOUSTON INDEPENDENT SCHOOL DISTRICT

BILLY R. REAGAN, GENERAL SUPERINTENDENT

AN EDUCATIONAL COURSEWARE CONSORTIUM: PROGRAMMING AMERICA FOR THE INFORMATION AGE

A POSITION PAPER BY

PATRICIA STURDIVANT. ASSOCIATE SUPERINTENDENT
FOR TECHNOLOGY

APRIL, 1983

PRELUDE

The public schools face some remarkable opportunities and challenges in developing a high technology environment. According to Chris Argyris, author of Leadership in the 80's, people feel that institutions are not performing as they should. School administrators are not going beyond "single loop learning," which he defined as the detection and correction of routines of operation. In other words, administrators tend to make incremental decisions — paring a budget item here, reorganizing a little there. Argyris contends that incrementation inhibits the invention of solutions needed to fully exploit the new information technology. New policies, routines and values are needed — not just "patch jobs."

Leaders with vision will form new constructs and take the risks necessary to carry them out. Bold action will be required and the propensity for risk taking will separate the new wave thinkers from the old-line bureaucrats.

The economic and military security of the United States depends upon the vitality of the country's educational system. Educational leaders have never had a more compelling calling. This paper examines the emerging role of technology and the need for an educational software consortium, the vital link that will support tomorrow's public schools.

THE TECHNOLOGICAL IMPERATIVE

As the U. S. moves from an industrial to an information society, brainpower will become more important than physical power. Technology has the potential to extend and enhance mental ability. The challenge facing America will be to train people to work in an information society. Jobs will be available for those with the high tech skills to fill them.

The Third World countries are taking over many industrial tasks. The U. S., in order to avoid massive unemployment, will need to venture forward as a provider of information, knowledge and expertise. Current weaknesses in science and technology education will contribute to the country's economic and military weakness. It will take energy, resources, effort and money to provide the right information at the right time. Education is the key.

Last year, the U. S. House Committee on Science and Technology (May 7, 1982) heard testimony on the economic implications of our technology lag.

- Without technological leadership, the U. S. economic position will decline along with the standard of living.
- Major and minor technology decisions will be poorly made.
- People will be pushed to their technological level of incompetence because talent is in such short supply.
- Leaders and managers will not be able to plan adequately because they do not understand technical opportunities and limitations and because they cannot depend upon knowledgeable employees.
- The quality of life for those who are not part of the technological elite will decline as people struggle to get their share of a shrinking economic pie.

COMPUTERS AND PUBLIC SCHOOLS

There's a computer revolution in progress and the public schools are at the heart of it. According to Dataquest, a California based research company, the number of microcomputers in the public schools will continue to triple each year. Despite declining revenues, administrators are buying computers in record numbers. By 1990, experts predict there will be two million computers in the public schools. According to a recent estimate in Time Magazine (January 1983), the average student/computer ratio is now 1:400. Despite a recent emphasis on the importance of computers in education, there are too few computers in most schools to make computer literacy for all students an achievable goal.

USA Today (April 21, 1983) reported that 91% of the U. S. population now thinks that students should learn to use computers in school in order to better prepare them for the future. Many states are moving swiftly toward computer literacy mandates (e.g., Florida, Tennessee, Minnesota) and some are initiating new computer training requirements for teachers (e.g., Texas, Pennsylvania, Massachusetts). Obviously schools must make substantial changes in order to prepare students for a computer oriented society. It's clear that the computer is becoming an increasingly important delivery system for education. But, even more significantly, the software that runs on the computer will have a major impact upon the development of both academic competence and computer literacy. This paper establishes the need and rationale for a major software development effort by the public schools.

With such universal agreement about the importance of computer literacy, it's surprising that computers have not made more of an impact. The pressures to integrate computer skills are coming from outside (rather than within) the educational establishment as evidenced by these trends:

- PTA's are buying computers for the schools through fund raising drives (Benson, Laura. "Erwin Open School Computer Program," Educational Computing, May 1982).
- Computer stores and colleges are offering courses for interested community members.
- The success of coin-operated versions of Pac Man prompted $1 billion in sales of home cartridges.

There is no doubt that students are fascinated by computers. Educators are intrigued by arcade games and wonder why they are so compelling to children. Students who are bored in school can spend hours riveted to video games. As computers proliferate in the schools, the challenge is to make software that is as exciting as the most compelling video game and as educational as the best crafted school lesson. Kids are interested in computers but changes come slowly. Electronic Learning, a computing journal for educators, recently reported on some of the deterrents that are slowing down the computers in education movement. Specifically the journal said that teachers and educators need computer training in order to adequately prepare their students.

ECONOMIC INDICATORS

Five years ago most administrators and teachers were apprehensive about computers. According to an Instructor Magazine survey, that situation has turned around. By May 1982, 85% of the nation's teachers were eager to upgrade their skills but lacked an opportunity to learn about computers. It appears that the current educational system has some of the right ingredients for change — technology oriented students, supportive parents and receptive staff — but the dollars for teacher training, hardware and software are not available.

Professor J. Licklider of MIT reported that one billion dollars a year would need to be spent by schools in order to capitalize on new information technologies (EDUCOM Bulletin, Winter 1981). With today's economic woes, it seems foolish to propose such a figure. Yet, we have a four trillion dollar economy that rests on the quality of our educational system. Education is a $200 billion a year industry that desperately needs overhauling. Curriculum development is like a critical bearing that supports a massive machine. The bearing is crumbling. If it crumbles, our entire society is in danger. The commitment to educational technology and software development is not an excessive investment — the entire future of our country depends upon it.

Realistic budgetary planning must take current technology into account. Obviously, staff salaries will continue to rise. The public schools have no alternative but to use computer technology to improve productivity and contain costs. With the computer's increasing capabilities, more and more of the curriculum can be conveyed through the use of technology. The teacher's role will change from disseminator to manager. Classroom organization models will become more work-station oriented. The traditional groupings of students by grade level will become increasingly less relevant since the computer will be able to accommodate a wide range of student interests and abilities. Learning will become a lifelong enterprise, not an exercise that takes place during the traditional six hour day.

One of the most critical factors facing public schools in this organizational and role transition is software — its availability, quality and cost. The software market is lagging far behind the current state of hardware development, therefore there are a limited number of programs now available. Much of the educational software currently on the market is inferior in quality. The good programs are expensive. While the cost of hardware is plummeting, the cost of the programs that run on it is increasing at staggering rates. One computing industry publication explains the trend: "Competition among hardware manufacturers will force prices down. Unlike hardware's technology-intensive development, software is labor-intensive, resulting in just the opposite price trend. Not only are a lot of manhours required to write a software program, but software is also entirely dependent upon programmers, an incresingly scarce and expensive pool of talent." (Infoworld, March 29, 1982.)

The escalating costs of educational software have already become obvious. Milliken, one of the nation's leading publishers of computer programs, has increased the cost of its math and reading programs 38% over the last two years. The consumer market has been impacted as well. David Wagman, chairman of the world's largest personal computer software distributor, reports that the retail price of software has been increasing by about 20% each year.

HARDWARE AND SOFTWARE REDIRECTION

The National Science Foundation published a report four years ago (Technology in Science Education: The Next Ten Years, July 1979) which pointed out a fundmental problem with technology adoption in the schools. Since education is so labor-intensive (districts spend an average of 87% of their annual budgets on salaries), there is little revenue left for hardware and software. The only possibility for rectifying this situation is a redirection of resources. If funding is made available, the future of educational technology will open up many new horizons for teaching children. According to Joseph Lipson's report to the Pre-College Commission on Math, Science and Technology (April 1983) there will be some significant hardware and software developments:

- Computer memory will continue to grow, providing for the development of more user-friendly programs.
- Large, flat, high resolution screens will be available for group instruction as well as powerful hand-held computing devices.
- Optical character readers will allow computer input of text documents.
- By 1995, speech recognition devices will be able to understand unfamiliar voices.
- Videodisc access will provide the teacher with additional means of organizing and presenting information.
- Networks will allow students to communicate with each other and share computer programs.

LOCUS OF CONTROL

Most status reports on public education emphasize the same problem. These concerns include eroding taxpayer support, diminished teacher competence, and declining SAT scores. But the basic problem is more important than any of these -- a disturbing shift in the locus of control.

The schools, and ultimately the teachers, are losing control of the curriculum. Parents, with their access to the computer as a pedagogical tool, are assuming an important role in the academic instruction of their children. The potential for using the computer as a tutor is hardly tapped with computer games like Adventure, Pac-Man and Lemonade.

PUBLISHING: TEXTBOOKS VS. SOFTWARE

For the last 200 years, publishers have controlled the curriculum. Committees of teachers and board members have selected books that reflect community values and skill requirements. Publishers have used "content experts" to write textbooks that have been adopted in cycles which usually last 5-10 years. Most publishers, fearing rejection of their textbooks in statewide adoptions, have made only superficial efforts to add a computer management system to their textbook series. None of the publishers have revamped their products to the extent that they are concentrating on electronic publishing. They are unwilling to surrender their current $2.2 billion a year textbook business.

As Dr. Robert Baker, President of Ginn and Company, a Xerox subsidiary explained, the school market would need to be $60 million to be viable. In 1982 school systems spent only $28 million for educational software. Continuing uncertainty about the availability of funds for instructional materials will probably continue to work against the publishers' willingness to develop computer software. In other words, publishers will continue to produce more of the same.

While the computer will not eliminate the need for textbooks, it will certainly diminish their importance. States will have to reexamine their textbook adoption procedures in view of these facts:

- In today's era of information explosion, textbooks become outdated quickly, particularly in science and social studies.

- Textbooks are organized for sequential presentation. The computer provides for random access, thereby increasing the opportunities for individualized instruction.

- The textbook publishers do not have the expertise within their companies that is required to develop computer software. Creative educational software has the potential to teach in an entertaining manner.

- Computer software has greater potential than textbooks for introducing challenges, providing learner feedback, offering flexibility, stimulating aesthetic consciousness, and motivating students.

Probably not. Software publishers are being advised to develop their wares for the home market rather than for the schools. TALMIS, an information and marketing company that keeps publishers up to date on technology, noted that the number of home computers will grow much more rapidly than the number of computers in the schools. TALMIS advised its subscribers to market materials that could be sold to parents. In view of this recommendation, it is not surprising that the supply of systematic coureware for school use is limited. Publishers find it easier to sell $39 games through retail computer stores. If the games are challenging, provide instant feedback and require problem solving skills, they will benefit students. However, there is a great need for computer programs that teach earth science, organic chemistry and advanced physics.

SOFTWARE PRODUCTION DILEMMA

Assuming that 80% of the school curriculum can be taught by computer by the year 1990, where will the schools find the software to do it? Even more importantly, how will they be able to afford quality programs if they are available?

If current trends continue, the schools will not have access to the programs they need. Educational publishers, the traditional suppliers of curriculum material, have been reluctant to invest their dollars in wide-scale software development. Hundreds of "cottage industries" have sprung up over the past five years. Many are producing video games and CAI programs that are piecemeal. According to Ann Piestrup, an industry expert, the funds spent on computer software for school use in only 10% of what is spent on development of home computer games (Theory Into Practice, Fall 1982). The quality of most educational software is largely "deplorable" according to Ken Komoski, Director of Educational Products Information Exchange, a national software clearinghouse for the Consumers Union. According to him, the key is quality, not quantity.

SOFTWARE CONSORTIUM NEEDED

Educational software development requires a big investment. To create quality programs, a developer must assemble a team of courseware design specialists, content advisors and expert programmers. Computer assisted design and development is an expensive undertaking. According to Dr. Dustin Heuston, Director of WICAT (a major software development firm), the average cost of a K-8 CAI package is $1 million. On the surface, this seems high, yet most large districts will probably spend that much on software by 1985. For example, the Houston Independent School District spent $55,000 on computer software in 1980. By 1983, the cost was $225,000. In another two years, the number of micros is expected to triple from 1,500 to 4,500 units. The District's $1 million software expense in 1985 will increase proportionately as the number of computers increases.

Districts all across the country are facing these problems with little resolution in sight. Specific problems include:

- Stiff pricing structures that require schools to purchase one copy of a program for each user with no free "back up" copies.
- Reluctance on the part of software vendors to lease their programs on a quantity-sale basis.
- Few computer programs available in areas other than reading/language arts and advanced mathematics.
- Refusal of publishers to make programs available on a computer network which would allow schools to reduce their software costs.
- Refusal of publishers to provide sample copies to schools for purposes of review and evaluation. Publishers fear having commercial software electronically copied.

The obvious solution to this software dilemma is to form a consortium to develop quality software programs. Few districts have attempted this development project because they do not have computer scientists, system analysts, courseware design specialists and microcomputer programmers on staff. This kind of talent is expensive but this necessary investment in human resources would pay off in terms of product development.

There is no doubt that the formation of an educational software consortium would be expensive. But in light of the competitive world economy our children will face, the question becomes not, "Can the nation afford to do this?" but rather, "Can it afford not to?"

Senator BENTSEN. I would now like to call on Mrs. Barbara O'Neal, who is president of the Texas State Teachers Association, and a person of substantial influence in education who has displayed great interest and leadership in seeking to improve public education all across Texas.

STATEMENT OF BARBARA O'NEAL, PRESIDENT, TEXAS STATE TEACHERS ASSOCIATION, AUSTIN, TEX.

Mrs. O'NEAL. Thank you, Senator Bentsen. And I'd like to speak personally to Mr. Reagan's recruitment. He is trying to recruit my 15-year-old son to go into education and come to Houston. So, yes, Mr. Reagan does recruit every place he travels in the State.

I am Barbara O'Neal and president of the Texas State Teachers Association, which is affiliated with the National Education Association. And on behalf of our 95,000 members whom we represent in Texas, I want to thank you for the opportunity to speak about the shortage of classroom teachers, which is reaching crisis proportions in Texas. And I believe unless comprehensive and effective action is taken soon, will have a crippling effect on the entire Nation by the end of this decade.

The Texas Education Agency reported in a study released earlier in this school year that Texas has current shortages of teachers not only in the fields of math and science, but in vocational education, special education, and bilingual education. Moreover, the agency projects that teacher shortages in these areas will become more severe in the next 5 to 8 years. And on the basis of vacancies advertised by school districts, we also know that many of them, especially the small, rural school districts, are having trouble finding English teachers and fine arts teachers.

In all, it is conservatively estimated that in Texas there will be a shortfall of about 4,300 qualified teachers on the average for each year remaining of this decade. More than one-fourth of this shortfall will occur at the elementary level. Nearly two-thirds will occur at the secondary level and the remaining one-eighth will occur in special education at both levels.

It is extremely important to take note of the fact that I said qualified teachers. While we know that there is not even enough warm bodies for certain vacant positions in some of the 1,080 school districts we have in Texas, there are many more positions in the critical areas I have mentioned that are filled by inadequately trained teachers.

For example, there are no outright teaching vacancies in the Edcouch-Elsa Independent School District in south Texas. But on the last day of school this year, three of the districts seven high school math teachers hold what is called an "emergency certificate." Two high school science teachers and two junior high special education teachers are in that same category.

These "emergency or special assignment" teaching permits are granted to teachers to enable them to temporarily teach a course they are not certified to teach on the condition that they concurrently obtain the necessary training in education to become certified in that area.

But for a variety of very valid reasons, including the inaccessibility of accredited colleges, many of these "temporary assignment" teachers do not complete the requirements for the correct certification. And so, consequently, a temporary certificate becomes almost a permanent assignment.

According to the Texas Education Agency, the use of these special permits has increased in many cases, has deteriorated to a year-by-year measure exercised to provide short-term relief rather than a long-term solution to the problem of an insufficient supply of available qualified teachers. I cannot over-emphasize the significance of this short-term, quick-fix answer because while it is filling the classroom with teachers, it is also diminishing the quality of education that our schools are offering and that, in turn, is diminishing the level of public support that we must have to actually solve the educational crisis confronting us.

I have reviewed statistical evidence related to this problem in the State of Texas and I will share that with you in a moment. But it was the personnel director of the Edcough-Elsa School District whom I mentioned before who made me realize the seriousness of this problem. He said his district, which advertises its teaching vacancies with every college and university placement office in Texas and in more than a dozen other States, finds himself in the position of not hiring the most qualified teacher for a given position, but employing whoever is the closest to being qualified, and then hoping that that person will complete the additional education he or she needs to be fully certified in a subject.

He called that "unfortunate:" I think it is disastrous.

These special permits that I have been talking about were used by more than one-half of the school districts in Texas during 1981–82—that is more than 500 school districts—to fill more than 5,500 vacant teaching positions. One-fourth of the permits were used at the secondary level in math and science, one-tenth in vocational education, and another one-fourth of these special permits were in special education and bilingual education, and then the rest just covered the gamut of subjects.

Various schemes are being tried to solve the problem, but, for the most part, they are again quick-fix solutions and not long-term answers. Many districts and educators and others are proposing to pay math and science teachers more than other teachers. This may or may not help attract additional teachers in these areas where the shortages are critical right now. However, as I have indicated, in Texas, currently there are shortages in other areas—vocational education, special education, and bilingual education. There will be shortages in these and other specializations in the State in the future. Shall we pay more money to teachers in each specialized area as the shortage erupts into a crisis, before it erupts or after it erupts into a crisis?

I do not believe that this approach is rational or reasonable.

In Dallas, the school district is proposing to offer part-time math and science teaching assignments to retired teachers, former teachers, college teachers, and even to nonteachers who are practicing scientists or mathematicians in the private sector. As a professionally trained educator, I recognize that many of these people have expertise. But I have a grave concern about putting people with no teaching training in charge of our classrooms.

You know, it is one thing to be an expert in a subject and to understand it, but it is quite another to be able to take that subject, break it down into small components, so that students may learn the material.

So this proposal of employing experts out of the private sector in classrooms might bring temporary relief. But again, as I pointed out before, it is not a long-range fundamental solution. The overall problem is much bigger.

For instance, Texas colleges and universities graduated 16,400 certified teachers in 1974. Then years later, they are graduating 5,000 teachers. According to a recent Dallas newspaper article, only five of last year's graduates were certified in math or science, teachers who intended to actually teach young people. Worse yet, the Texas Education Agency, an independent researcher, say that as many as one-third of the newly certified teachers in Texas elect not to accept a teaching position.

And at the same time, the number of elementary and secondary school students in Texas is projected to increase 50 percent between 1980 and the year 2000. We are not having a declining birth rate in Texas, and that trend, which is very dramatic in Texas and in the other Sun Belt States, I think will also have an effect on the Nation as a whole.

We know that teachers also are leaving their classrooms and their profession. A recent survey conducted by the Sam Houston State University found that about 40 percent of the teachers resigned within the first 5 years of teaching. A Dallas Times-Herald poll taken in September 1981 showed that 43 percent of the teachers who resigned from the Dallas Independent School District had less than 6 years of teaching experience.

And more than 2 years ago, based on the evidence then that I and other leaders of TSTA had, we told the citizens of Texas that their public schoolteachers were conducting a "silent strike" meaning that they were quietly leaving the schools and their profession in record numbers. And that silent strike continues, unabated today. Furthermore, such diverse organizations as the Texas State Teachers Association, Sam Houston State University Research Team, the Texas Education Agency, and most major Texas newspapers agree on the reasons for it. First, low pay at the entry level and a salary schedule that provides no career incentives. Also the lack of recognition and appreciation and respect by the public for schoolteachers are tops on that list.

Then the lack of effective input into the decisions that affect learning and teaching is another top reason. Additionally, both administrators and teachers say that the lack of parental support in student discipline, study habits, and constructive attitudes toward academic achievement is another important reason why educators, in effect, are just dropping out.

It is clear that the shortage of teachers, not to mention equipment and other resources, is now acute in the area of math and science. But all of the available evidence indicates that the problem confronting public education and therefore the Nation, is much broader than that. Perhaps the focus of the moment is on science and math because those areas of endeavor have not been designated as national priorities in recent years.

I would like to read an excerpt from a news release to illustrate my point. It was predicted, and I quote:

> That the struggle to provide competent teachers—especially science teachers—"casts its shadow far into the future." The years just ahead are certain to bring new problems in a different framework and of even greater magnitude.

Those words were taken from a news release issued by the NEA on November 4, 1957. Sputnik and President John Kennedy's subsequent call to action was so successful, that within a decade or so, most of us were lulled into a complacent satisfaction by the belief that the United States was superior in every respect to every other country of the world.

With that confidence, our young people chose not to pursue math and science as careers because they are difficult subjects. Nor did their parents insist that they do so. Enrollment in science and math classes dropped. But the demand in private industry for people trained in those areas increased and many teachers, for reasons I have already stated, saw the opportunity to double or triple their salaries and left teaching.

Now, in accordance with the laws of supply and demand, the public schools cannot afford to get them back and the public and the children are now paying for our collective short-sightedness.

I suggest that we learn from the crisis in education of our young people, which is being widely noted and commented upon by national commissions, policymakers, and observers of public affairs. And I commend you, Senator Bentsen, for your recognition of the reality that science and math education is in a crisis and I suggest that we must invest the resources of this great Nation in all our children in all aspects of their education.

Yes, today, the problem may be in math and science, but the next crisis to face this Nation may be in our diplomatic programs because fewer and fewer students are studying foreign language, let alone mastering it.

I do not contend that there is one simple answer. There are a variety of measures we can support. We can and should encourage individuals by providing incentives. Both practicing teachers and potential teachers need some incentives to achieve certification in areas of critical shortage. These incentives can be in the form of both loans and grants for the cost of appropriate education and training. Taxpayers and policymakers at the State and local levels need to address their responsibilities to adequately compensate teachers, a most critical need in our home State of Texas at the present time.

The problem is immense. It deserves an equally huge Federal commitment as well. We need comprehensive Federal legislation that provides incentives for local school districts to improve their own educational programs in critical areas relating to national priorities and to those that stimulate economic growth and provide for a strong defense.

The American Defense Education Act is such a proposal. We need the Federal Government's assistance to local school districts to improve academic programs by adding qualified teachers and increasing both the number and the quality of course offerings in math and science and other areas critical to the understanding of high technology.

We need long-term solutions.

Make no mistake, we are well aware that those solutions will require money. In Texas, Columnist Jim Schultze of the Dallas Times-Herald summed it up pretty well. He wrote:

> Most people in Texas know that we're horribly behind on teacher pay and that if we don't pony up and pay a reasonable amount of money for education in this state, Texas will fall off its boom and become a fifth-rate Gomer Pyle wasteland where the only thing worth talking about is okra.

[Laughter.]

Mrs. O'Neal. Well, we in Texas will leave the discussion of the status of okra to the Department of Agriculture, and certainly we do not want that message applying to the State of Texas, and we certainly don't want that message applying to the Nation.

We trust that you can act to prevent it from applying to the Nation as well.

Thank you, Senator Bentsen.

Senator Bentsen. Thank you very much, Mrs. O'Neal. I heard your comments about the Federal commitment. Frankly, I was quite surprised when I saw that President Reagan had endorsed the findings and the recommendations of his Commission on Excellence in Education because there is a great gap between his rhetoric on our education problems and what has actually been proposed in his budget.

I saw him at a meeting with some students the other day in which one of the students posed this question: "If you're really for education, then why are you cutting back on Pell grant loans for students to go to college?" He went on to list a number of other programs that have been cut in the way of Federal assistance in education. The President replied by, in effect, saying that more money was being spent today than was spent a number of years ago on education.

That was very misleading. What he was doing was lumping together spending in all the local school districts, States, and counties. But the facts are that looking at just Federal spending, this administration, in the way of education, has proposed some very substantial cuts.

I listened to Mr. Turnbull talking about the growing educational attainments of low-income families. That reflects the fact that we have had striking success with Federal funding provided under chapter 1 of the Education Consolidation Improvement Act in the past in boosting math and reading skills for low-income children. Yet, the President has proposed to cut that program by over 30 percent.

There is just an enormous gap between his rhetoric and what he actually proposed.

Mrs. O'Neal. Senator Bentsen, if I might give a personal example as to the effect of those Federal cuts in chapter 1. I taught in a sixth grade center and taught chapter 1 kids. And when those cuts came down, we had to cut personnel and we had children that did not get into those reading and math programs.

So I have seen the effect personally in my own school building of those Federal cuts.

Senator Bentsen. I have a number of other questions, but I want to move along because I'm concerned about a vote coming. I want very much to have Ms. Betty Pyle testify. She is the president of the Texas Classroom Teachers Association and has had a long interest and influence in education in Texas, as well. We are very pleased to have you here.

STATEMENT OF BETTY PYLE, PRESIDENT, TEXAS CLASSROOM TEACHERS ASSOCIATION

Ms. PYLE. Thank you, Senator. I am very pleased to be here. I have been on several panels with Mr. Reagan and I have to tell you that he's always a hard act to follow.

Just for the record, I would like to say that I am an Earth and life science teacher employed in the Ector County Independent School District in Odessa, Tex., and I am the State president of the Texas Classroom Teachers Association, which is the only independent classroom teacher association in the State of Texas. We have a long history of believing that the future of this country is going to be dependent upon having skilled and dedicated teachers meeting the challenges of education in our changing society.

So I do consider it a privilege and an honor to be here to discuss some of these problems with you and especially the problems that we are confronting in the shortage of math and science teachers.

You have been given quite a number of statistics nationwide and some on the State level. I would like to expand for just a moment on some of the statistics that we are facing in Texas.

From 1973 to 1981, we had over a 50-percent decline in certified teachers coming out of our colleges of education. In 1981 and 1982, one-third of all the teachers holding a temporary classroom assignment permit and one-half of all these permits at the secondary level were in the math and science fields. Eighty-four percent of the districts that were surveyed by the Texas Education Agency reported a shortage of secondary math teachers. Seventy-seven percent of them report an anticipated shortage of science teachers.

TEA has projected an annual shortfall of new teachers of 4,340 for the rest of the decade. The greatest shortages are anticipated, as Barbara O'Neal told you, in math, vocational education, bilingual education, special education, and science. The National Council of Teachers of Mathematics reports that only 20 new math teachers graduated in Texas in 1982, and 13 of those went into other fields.

The implementation of House bill 246, which is the curriculum reform bill passed by the 67th Legislature in 1981 is expected to increase high school graduation requirements in math and science, thus making the current shortage of qualified personnel even more severe. And to make matters even worse, the final 1980 census count for the State of Texas reported over 14 million people, an increase of 27.1 percent and over 3 million persons since the 1970 census. By comparison, the Nation grew 11 percent over that same decade.

The Texas 2000 report projects a possible State population of 22 million by the year 2000. This percentage growth would be 55 percent, far outstripping the Census Bureau's projected growth rate of 17 percent for the Nation.

The population projection suggest that elementary school enrollment will continue to grow at least until the year 2000 and between

1980 and the year 2000, the projected total increase is about 1.6 million. These numbers suggest that the overall demand for teachers and other school personnel, as well as instructional materials, transportation services and facilities, will continue to rise. And as a consequence, the demand for public school education funds is unlikely to slacken during the next 20 years.

Teacher educators and school administrators point to low salaries, the deterioration image of teaching as a profession, and less desirable working conditions as primary factors leading to individuals' decisions to stay out of teaching as a career. There have been a number of studies that confirm this.

I would like to point out one bit of data to you. Since 1969, the proportion of parents who want a child of theirs to become a public school teacher dropped from 75 percent to 48 percent. And less than 5 percent of college freshmen in 1980 wanted to go into teaching, which was down 40 percent from 10 years ago. Upon surveying 450 teacher placement offices, the National Science Teachers Association found that the number of qualified people available to accept teaching positions in science and mathematics has declined in the past decade down 79 percent in math and 64 percent in science.

And the magnitude of this problem lies in the critical role that the mastery of mathematics and science plays in providing skilled scientists and technicians for the continued technological and economic development of our country and our State.

In addition to the need for well-trained manpower in our so-called high-tech industry, technological advances are increasingly making mathematics and science knowledge and skills prerequisites for jobs across the occupational spectrum. The realities of world trade and new technology holds fundamental economic and educational challenges for the United States. Technological innovations are forcing changes in the world economy and these changes dictate that we rethink the goals, the financing, and the structure of our educational systems. The importance of education to our economic well-being requires that we repair and improve the system of public schools.

Schools have received a lot of criticism in the last few years and a number of these studies have been made in an attempt to identify the problems and find solutions. The National Commission on Excellence in Education report that was recently issued by Secretary Bell is a very thorough, and far-reaching endeavor and the committee is to be highly commended for its work. Time does not permit me to elaborate as I would like on this report, but it will suffice to say that this committee made clear that solutions to the Nation's problems in education will not be found without the full support of all of society.

When we talk about criticism of education, we must keep in mind that free public education was never designed to deliver quantity with quality. It was designed to deliver equality. It was asked to provide every child with a chance to obtain an education and this mandate has been realized, for we are giving children a chance to be taught. And we are the first Nation in the history of the world to give everyone a chance for an education.

Over the past decades our public schools have taken on numerous social responsibilities, including the teaching of subjects like drug education, sex education, and most recently, the teaching of undocumented children. And on the whole, the schools have done a good job. No nation in the history of the world has ever embarked on so bold an experiment in education as has this one. Our achievements over the years in education and society in general have been impressive, for today we have students of both sexes, of many nations and of all ages, and that is a good thing.

Today, over 94 percent of all of our students are in school, and that is well above the 52 percent that were eligible in the 1950's. We have programs for the hard to educate. We have programs for the gifted. And we have programs for the handicapped. Wherever need has been recognized, we in education have tried to fill it.

But our critics should not be surprised that this achievement has sometimes taken its toll on quality. Public expenditures for education over the past century have never been sufficient to increase opportunity and maintain quality, too. Even the best public schools have had to endure a reduction in quality as their doors opened to increasing numbers of students from increasingly diverse backgrounds.

We have had our successes and these successes should not be ignored, for they are part of the hallmark of our country. But there is another side and we must all, both in and out of education, face it squarely. We do have some very serious problems in public education and if we are to prevent social and economic deterioration of our Nation, we cannot wait any longer to resolve these compelling issues. While there is controversy over the role that the Federal Government should play with regard to education, few would argue that our country should have a national commitment to education.

As a priority, we believe that the appropriate role of the Federal Government in meeting the pressing problems in math and science and related areas and in education in general should include the following:

One, we recommend that the Federal Government appropriate the necessary funds to implement a nationwide publicity campaign to enhance the image of the teaching profession and place special emphasis on increasing public awareness of the importance of math, science, and computer science in daily living in careers and in the Nation's economy. This campaign should include television messages by the President, key public and elected officials, industrial leaders, classroom teachers, and leading citizens and scientists. The campaign should also seek to make the public aware of its responsibility in providing quality education.

Parents should be made aware that they have a right to demand the very best of schools and colleges. But they also have a responsibility to participate actively in their child's education.

As teachers, we know that though people know the fulfillment of their dream lies in being educated, many fight for an inferior education. That is because although people want to be educated, they often say that they want easier courses, less work, no tests, no homework, and above all, they want an easy teacher. That is, they do at the time they are being educated, but they don't when they are out in the marketplace trying to make their dreams come true.

We must emphasize to parents that quality education begins at home.

Two, increasing the teacher supply in mathematics and science should be a major concern to the Federal Government. Scholarship and loan programs should be made available for attracting potential math, science, and computer science teachers as well as for the retaining of existing teachers.

Taking a page from the extensive National Science Foundation program that was established to update math and science teaching after Sputnik, our National Government should establish imaginative and effective programs to be administered by the State that focuses on the problem of attracting youth to math and science teaching fields. The first consideration of any such program should be to alleviate the shortage of certified math, science, and computer science teachers at the secondary level and to upgrade the quality of these programs at the elementary level.

Three, due to the serious problem of the shortage of certified and qualified math and science teachers, this Nation cannot afford to wait until students now entering college are ready to start filling the many vacant positions.

In a recent report from the Phi Delta Kappa, they said that teachers need training alternatives. We need to reconsider how we educate and reeducate teachers. We need to try alternative ways to train science teachers. We might consider, for example, one, internships in business or industries that allow teachers to apply the science that they teach in the classroom; two, summer sabbatical plans or other in-service training methods whereby teachers are kept up-to-date on new science and technology and are given firsthand experience with the latest equipment and materials; and three, partnerships with the State and local communities in an attempt to match curriculum requirements to the jobs that are available.

Four, the Federal Government should encourage local school districts to initiate new and innovative programs that will enhance the classroom setting and give additional meaning to the disciplines taught. Such a program is an outdoor learning center, for an example, where students journey to an outdoor site and participate in real life experiences with a structured format. Such centers given additional meaning to what is taught in a classrom setting. The Federal role would be to aid the districts financially in establishing such programs based upon flexible guidelines.

Five, the Department of Education, in allocating funds for curriculums or other programs should not only encourage but make certain that the system is accessible to all individuals involved. The funds of the 1960's went largely to colleges or to college-connected curriculum developers, writers, and researchers. Not until the major portion of these funds were committed and the designs were underway was it recognized as important, or even realized, that the classroom teacher had been left out of the process.

Yet, it is the classroom teacher who can make or break curriculum reform. The classroom teacher is also the one who receives the criticism when these reforms do not work.

To succeed, curriculum reform and refinement must involve not only classroom teachers, but also parents and the local business community. This time when we allocate funds to bring science and math teaching up to the desired standards, we must include teachers, school boards, parents, and community members at large in the process, for there is no better way to gain support than to have everyone involved.

Senator **Bentsen**. Ms. Pyle, the Senate has gone into session on us and we are going to have a vote very soon. We will include your prepared statement in the hearing record in its entirety, but I would ask you to summarize the balance of it now, if you will, please.

Ms. **Pyle**. OK. And the sixth thing that we would ask you to do is to work with the legislature to help raise teachers' salaries and certainly, last but not least, that we would ask that we all work together in solving these problems.

We would call upon you as the national leaders to heed to recommendations listed by the Commission and upon our national leaders to set the trend illustrating to the American people that education is a national priority. And we would call upon our colleagues all across this great Nation for us all to work together in a very positive manner, to work together in the spirit of the Commission on Education, as they said it, and not to play the blame game, for that will get us nowhere.

We in Texas know that we only have a few years remaining for our economy to depend upon the oil. And after that, it is going to depend upon processing of knowledge, application of knowledge, and the creation of knowledge.

We stand ready as teachers to work with you, help you in any way, and to assume our fair share of the responsibility for this crucial endeavor.

We thank you for the opportunity to be here.

[The prepared statement of Ms. Pyle follows:]

PREPARED STATEMENT OF BETTY PYLE

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE, MY NAME IS BETTY PYLE. I AM AN EARTH AND LIFE SCIENCE TEACHER IN THE ECTOR COUNTY INDEPENDENT SCHOOL DISTRICT, ODESSA, TEXAS, AND I AM PRESENTLY SERVING AS STATE PRESIDENT OF THE TEXAS CLASSROOM TEACHERS ASSOCIATION (TCTA).

TCTA, FOUNDED IN 1927, IS THE ONLY INDEPENDENT TEACHER ASSOCIATION IN TEXAS-- OF TEACHERS AND FOR TEACHERS, WORKING SOLELY FOR THE INTERESTS OF QUALITY PUBLIC EDUCATION. IT IS OUR BELIEF THAT THE FUTURE OF PUBLIC EDUCATION IN TEXAS AND THIS COUNTRY DEPENDS UPON SKILLED AND DEDICATED TEACHERS QUALIFIED TO MEET THE CHALLENGES AND PROBLEMS OF EDUCATING A CHANGING SOCIETY. THEREFORE, IT IS A PRIVILEGE FOR ME TO HAVE THIS OPPORTUNITY TO APPEAR BEFORE YOU TO DISCUSS SOME OF THESE PROBLEMS AND ESPECIALLY THE SERIOUS CRISIS CONFRONTING PUBLIC EDUCATION TODAY; THE SEVERE SHORTAGE OF QUALIFIED MATHEMATICS AND SCIENCE TEACHERS. THE FOLLOWING STATISTICS ILLUSTRATE THE SERIOUSNESS OF THIS PROBLEM:

NATIONAL

*77% DECLINE FROM 1971 TO 1980 IN CERTIFIED TEACHERS PREPARED TO TEACH SECONDARY MATHEMATICS. (3)

*65% DECLINE FROM 1971 TO 1980 IN CERTIFIED TEACHERS PREPARED TO TEACH SECONDARY SCIENCE. (3)

*IN 1980, AVAILABLE MATH TEACHERS COULD FILL ONLY 78% OF AVAILABLE JOBS.

*SEVERE SHORTAGES OF SECONDARY MATH TEACHERS WERE REPORTED IN 43 STATES, OF SCIENCE TEACHERS IN 33 STATES, AND OF PHYSICS TEACHERS EVERYWHERE. (4)

TEXAS

*OVER 50% DECLINE IN CERTIFIED TEACHERS PRODUCED FROM 1973 TO 1981 (15,623 IN 1973; ABOUT 7,500 IN 1981). (1)

*IN 1981-82, ONE-THIRD OF ALL TEMPORARY CLASSROOM ASSIGNMENT PERMITS, AND ONE-HALF OF ALL TCAP'S AT THE SECONDARY LEVEL, WERE IN MATH AND SCIENCE. (1)

*84% OF DISTRICTS SURVEYED BY TEA ANTICIPATE A SHORTAGE OF SECONDARY MATH TEACHERS; 77% OF DISTRICTS ANTICIPATE A SHORTAGE OF SECONDARY SCIENCE TEACHERS. (1)

*TEA has projected an annual shortfall of new teachers of 4,340 for the rest of the decade. Greatest shortages are anticipated in math, vocational education, bilingual education, special education, and science. (1)

*The National Council of Teachers of Mathematics reports that only 20 new math teachers graduated in Texas in 1982, and 13 of those went into other fields.

*The implementation of House Bill 246, the curriculum reform measure passed in 1981, is expected to increase high school graduation requirements in math and science, making the current shortage of qualified personnel even more severe.

The final 1980 Census count for the state was 14,229,191, an increase of 27.1 percent and 3,030,536 persons since the 1970 Census. By comparison, the nation grew 11 percent over the decade. The Texas 2000 report projects a possible state population of 22 million in the year 2000. Percentage growth would be 55 percent, far outstripping the Census Bureau's projected growth rate of 17 percent for the nation. (2)

The population projections suggest that elementary school enrollments will continue to grow at least until the year 2000. Between 1980 and the year 2000 the projected total increase is about 1.6 million. These numbers suggest that overall demand for teachers and other school personnel, as well as instructional materials, transportation services and facilities will continue to rise. As a consequence, the demand for public school education funds is unlikely to slacken during the next 20 years. (2)

Teacher educators and school district administrators point to low salaries, the deteriorating image of teaching as a profession, and less desirable working conditions as primary factors influencing individuals' decisions to stay out of teaching as a career. Several national studies confirm these observations. (1)

-----ALMOST FIVE TIMES MORE SCIENCE AND MATH TEACHERS LEFT TEACHING LAST YEAR FOR EMPLOYMENT IN NON-TEACHING JOBS THAN LEFT DUE TO RETIREMENT. (4)

-----NATIONWIDE, 22% OF TEACHING POSTS IN MATHEMATICS ARE UNFILLED. (3)

-----SINCE 1969, THE PROPORTION OF PARENTS WHO WANT A CHILD OF THEIRS TO BECOME A PUBLIC SCHOOL TEACHER DROPPED FROM 75% TO 48%. LESS THAN 5% OF COLLEGE FRESHMEN (1980) WANTED TO GO INTO TEACHING, DOWN 40% FROM 10 YEARS AGO. (3)

-----UPON SURVEYING 450 TEACHER PLACEMENT OFFICES, THE NATIONAL SCIENCE TEACHERS ASSOCIATION FOUND THAT THE NUMBER OF QUALIFIED PEOPLE AVAILABLE TO ACCEPT TEACHING POSITIONS IN SCIENCE AND MATHEMATICS HAD DECLINED PRECIPITOUSLY IN THE PAST DECADE, DOWN 79% IN MATHEMATICS AND 64% IN SCIENCE. (3)

THE MAGNITUDE OF THE PROBLEM LIES IN THE CRITICAL ROLE THAT MASTERY OF MATHEMATICS AND SCIENCE PLAYS IN PROVIDING SKILLED SCIENTISTS AND TECHNICIANS FOR THE CONTINUED TECHNOLOGICAL AND ECONOMIC DEVELOPMENT OF OUR COUNTRY AND OUR STATE. IN ADDITION TO THE NEED FOR WELL-TRAINED MANPOWER IN OUR SO-CALLED "HIGH-TECH" INDUSTRY HOWEVER, TECHNOLOGICAL ADVANCES ARE INCREASINGLY MAKING MATHEMATICS AND SCIENCE KNOWLEDGE AND SKILLS PREREQUISITES FOR JOBS ACROSS THE OCCUPATIONAL SPECTRUM. THE REALITIES OF WORLD TRADE AND NEW TECHNOLOGY POSE FUNDAMENTAL ECONOMIC AND EDUCATIONAL CHALLENGES FOR THE U.S. TECHNOLOGICAL INNOVATIONS ARE FORCING CHANGES IN THE WORLD ECONOMY. THESE CHANGES DICTATE THAT WE RETHINK THE GOALS, FINANCING, AND STRUCTURE OF OUR EDUCATIONAL SYSTEMS. THE IMPORTANCE OF EDUCATION TO OUR ECONOMIC WELL-BEING REQUIRES THAT WE REPAIR AND IMPROVE THE SYSTEM OF PUBLIC SCHOOLS.

SCHOOLS HAVE RECEIVED MUCH CRITICISM IN THE LAST FEW YEARS AND A NUMBER OF STUDIES HAVE BEEN MADE IN AN ATTEMPT TO IDENTIFY THE PROBLEMS AND FIND SOLUTIONS. THE NATIONAL COMMISSION ON EXCELLENCE IN EDUCATION REPORT RECENTLY ISSUED BY SECRETARY BELL IS A VERY THOROUGH AND FAR-REACHING ENDEAVOR, AND THE COMMITTEE IS TO BE HIGHLY COMMENDED FOR ITS WORK. TIME DOES NOT PERMIT ME TO ELABORATE AS I WOULD LIKE ON THIS REPORT, BUT IT WILL SUFFICE TO SAY THAT THE COMMITTEE MADE CLEAR THAT SOLUTIONS TO

THE NATION'S PROBLEMS IN EDUCATION WILL NOT BE FOUND WITHOUT THE FULL SUPPORT OF ALL OF SOCIETY: PARENTS, STUDENTS, TEACHERS, ADMINISTRATORS, PUBLIC POLICY MAKERS, BUSINESS, INDUSTRY AND THE GENERAL PUBLIC; AND WE STRONGLY CONCUR.

WE MUST ALL KEEP IN MIND THAT FREE PUBLIC EDUCATION WAS NEVER DESIGNED TO DELIVER QUANTITY WITH QUALITY. IT WAS DESIGNED TO DELIVER EQUITY.

IT WAS ASKED TO PROVIDE EVERY CHILD WITH A CHANCE TO OBTAIN AN EDUCATION. THIS MANDATE HAS BEEN REALIZED; WE ARE GIVING CHILDREN A CHANCE TO BE TAUGHT, AND WE ARE THE FIRST NATION IN THE HISTORY OF THE WORLD TO GIVE EVERYONE A CHANCE FOR EDUCATION. OVER THE PAST DECADES OUR PUBLIC SCHOOLS HAVE TAKEN ON NUMEROUS SOCIAL RESPONSIBILITIES INCLUDING THE TEACHING OF SUBJECTS LIKE DRUG EDUCATION, SEX EDUCATION, AND MOST RECENTLY THE TEACHING OF UNDOCUMENTED CHILDREN.

AND ON THE WHOLE, OUR SCHOOLS HAVE DONE AN EXCELLENT JOB. NO NATION IN THE HISTORY OF THE WORLD HAS EVER EMBARKED UPON SO BOLD AN EXPERIMENT IN EDUCATION, AS HAS THIS ONE. OUR ACHIEVEMENTS OVER THE PAST SEVERAL YEARS IN EDUCATION, AND SOCIETY IN GENERAL, HAVE INDEED BEEN IMPRESSIVE. TODAY WE HAVE STUDENTS OF BOTH SEXES, OF MANY NATIONS, AND OF ALL AGES----AND THAT IS A GOOD THING. AN OVERWHELMING MAJORITY, 96%, OF OUR YOUNG PEOPLE ARE IN SCHOOL. THAT'S WELL ABOVE THE 52% OF THE ELIGIBLE WHO WERE IN OUR SCHOOLS IN THE 1950'S. WE HAVE PROGRAMS FOR THE HARD TO EDUCATE, GIFTED, AND HANDICAPPED. WHEREVER A NEED HAS BEEN RECOGNIZED, WE IN EDUCATION HAVE TRIED TO FILL IT. OUR CRITICS SHOULD NOT BE SURPRISED THAT THIS ACHIEVEMENT HAS SOMETIMES TAKEN ITS TOLL ON QUALITY. PUBLIC EXPENDITURES FOR EDUCATION OVER THE PAST CENTURY HAVE NEVER BEEN SUFFICIENT TO INCREASE OPPORTUNITY AND MAINTAIN QUALITY, TOO. EVEN THE BEST PUBLIC SCHOOLS HAVE HAD TO ENDURE A REDUCTION IN QUALITY AS THEIR DOORS OPENED TO INCREASING NUMBERS OF STUDENTS FROM INCREASINGLY DIVERSE BACKGROUNDS. WE HAVE HAD OUR SUCCESSES AND THESE SUCCESSES SHOULD NOT BE IGNORED--FOR THEY ARE PART OF THE HALLMARK OF OUR COUNTRY, BUT THERE IS ANOTHER SIDE AND ALL OF US, BOTH IN AND OUT OF THE EDUCATION

FIELD, MUST FACE IT SQUARELY. WE DO HAVE SOME VERY SERIOUS PROBLEMS IN PUBLIC EDUCATION AND IF WE ARE TO PREVENT SOCIAL AND ECONOMIC DETERIORATION OF OUR NATION, WE CANNOT WAIT ANY LONGER TO RESOLVE THESE COMPELLING ISSUES. WHILE THERE IS CONTROVERSY OVER THE ROLE THAT THE FEDERAL GOVERNMENT SHOULD PLAY WITH REGARD TO EDUCATION, FEW WOULD ARGUE THAT OUR COUNTRY SHOULD HAVE A NATIONAL COMMITMENT TO EDUCATION. AS A PRIORITY, WE BELIEVE THE APPROPRIATE ROLE OF THE FEDERAL GOVERNMENT IN MEETING THE PRESSING PROBLEMS IN MATH, SCIENCE AND RELATED AREAS SHOULD INCLUDE THE FOLLOWING:

1) WE RECOMMEND THAT THE FEDERAL GOVERNMENT APPROPRIATE NECESSARY FUNDS TO IMPLEMENT A NATIONWIDE PUBLICITY CAMPAIGN TO ENHANCE THE IMAGE OF THE TEACHING PROFESSION AND PLACE SPECIAL EMPHASIS ON INCREASING PUBLIC AWARENESS OF THE IMPORTANCE OF MATHEMATICS, SCIENCE AND COMPUTER SCIENCE IN DAILY LIVING, IN CAREERS, AND THE NATION'S ECONOMY. THIS CAMPAIGN SHOULD INCLUDE TELEVISION MESSAGES BY THE PRESIDENT, KEY PUBLIC AND ELECTED OFFICIALS, INDUSTRIAL LEADERS, CLASSROOM TEACHERS, AND LEADING CITIZENS AND SCIENTISTS. THE CAMPAIGN SHOULD ALSO SEEK TO MAKE THE PUBLIC AWARE OF ITS RESPONSIBILITY IN PROVIDING QUALITY EDUCATION.

PARENTS SHOULD BE MADE AWARE THAT THEY HAVE A RIGHT TO DEMAND THE VERY BEST OF SCHOOLS AND COLLEGES, BUT THEY ALSO HAVE A RESPONSIBILITY TO PARTICIPATE ACTIVELY IN THEIR CHILD'S EDUCATION. AS TEACHERS, WE KNOW THAT THOUGH PEOPLE KNOW THE FULFILLMENT OF THEIR DREAM LIES IN BEING EDUCATED, MANY FIGHT FOR AN INFERIOR PRODUCT . THAT'S BECAUSE ALTHOUGH PEOPLE WANT TO BE EDUCATED, THEY OFTEN SAY THAT THEY ALSO WANT EASIER COURSES, LESS WORK, NO TESTS, NO HOMEWORK, AND ABOVE ALL, AN EASY TEACHER. THAT IS, THEY DO AT THE TIME THEY ARE BEING EDUCATED. THEY, DON'T WHEN THEY ARE OUT IN THE MARKET PLACE TRYING TO MAKE THEIR DREAMS COME TRUE. WE MUST EMPHASIZE TO PARENTS THAT QUALITY EDUCATION BEGINS AT HOME.

2) INCREASING THE TEACHER SUPPLY IN MATHEMATICS AND SCIENCE SHOULD BE A MAJOR CONCERN OF THE FEDERAL GOVERNMENT. SCHOLARSHIP AND LOAN PROGRAMS SHOULD BE MADE AVAILABLE FOR ATTRACTING POTENTIAL MATHEMATICS, SCIENCE, AND COMPUTER SCIENCE TEACHERS AS WELL AS FOR RETAINING EXISTING TEACHERS. TAKING A PAGE FROM THE EXTENSIVE NATIONAL SCIENCE FOUNDATION PROGRAM THAT WAS ESTABLISHED TO UPDATE MATHEMATICS AND SCIENCE TEACHING AFTER SPUTNIK, OUR NATIONAL GOVERNMENT SHOULD ESTABLISH IMAGINATIVE AND EFFECTIVE PROGRAMS TO BE ADMINISTERED BY THE STATES THAT FOCUS ON THE PROBLEM OF ATTRACTING YOUTH TO MATHEMATICS AND SCIENCE TEACHING FIELDS. THE FIRST CONSIDERATION OF THIS PROGRAM SHOULD BE TO ALLEVIATE THE SHORTAGE OF CERTIFIED MATHEMATICS, SCIENCE, AND COMPUTER SCIENCE TEACHERS AT THE SECONDARY LEVEL, AND TO UPGRADE THE QUALITY OF THESE PROGRAMS AT THE ELEMENTARY LEVEL.

3) DUE TO THE SERIOUS PROBLEM OF THE SHORTAGE OF CERTIFIED AND QUALIFIED MATHEMATICS AND SCIENCE TEACHERS, THIS NATION CANNOT AFFORD TO WAIT UNTIL STUDENTS NOW ENTERING COLLEGE ARE READY TO START FILLING THE MANY VACANT POSITIONS.

TEACHERS NEED TRAINING ALTERNATIVES. WE NEED TO RECONSIDER HOW WE EDUCATE AND RE-EDUCATE TEACHERS. WE NEED TO TRY ALTERNATIVE WAYS TO TRAIN SCIENCE TEACHERS. WE MIGHT CONSIDER, FOR EXAMPLE: 1) INTERNSHIPS IN BUSINESS OR INDUSTRY THAT ALLOW TEACHERS TO APPLY THE SCIENCE THAT THEY TEACH IN THE CLASSROOM, 2) SUMMER SABBATICAL PLANS OR OTHER INSERVICE TRAINING METHODS WHEREBY TEACHERS ARE KEPT UP TO DATE ON NEW SCIENCE AND TECHNOLOGY AND ARE GIVEN FIRSTHAND EXPERIENCE WITH THE LATEST EQUIPMENT AND MATERIALS, AND 3) PARTNERSHIPS WITH THE STATES AND LOCAL COMMUNITIES IN AN ATTEMPT TO MATCH CURRICULUM REQUIREMENTS TO THE JOBS THAT ARE AVAILABLE. (5)

4) THE FEDERAL GOVERNMENT SHOULD ENCOURAGE LOCAL SCHOOL DISTRICTS TO INITIATE NEW AND INNOVATIVE PROGRAMS THAT WILL ENHANCE THE CLASSROOM SETTING AND GIVE ADDITIONAL MEANING TO THE DISCIPLINES TAUGHT. ONE SUCH PROGRAM IS

AN OUTDOOR LEARNING CENTER WHERE STUDENTS JOURNEY TO AN OUTDOOR SITE AND PARTICIPATE IN REAL LIFE EXPERIENCES WITH A STRUCTURED FORMAT. SUCH CENTERS GIVE ADDITIONAL MEANING TO WHAT IS TAUGHT IN A CLASSROOM SETTING. THE FEDERAL ROLE WOULD BE TO AID THE DISTRICTS FINANCIALLY IN ESTABLISHING SUCH PROGRAMS BASED UPON FLEXIBLE GUIDELINES.

5) THE DEPARTMENT OF EDUCATION IN ALLOCATING FUNDS FOR CURRICULA OR OTHER PROGRAMS, SHOULD NOT ONLY ENCOURAGE, BUT MAKE CERTAIN THAT THE SYSTEM IS ACCESSIBLE TO ALL INDIVIDUALS INVOLVED. THE FUNDS OF THE SIXTIES WENT LARGELY TO COLLEGES OR TO COLLEGE CONNECTED CURRICULUM DEVELOPERS, WRITERS, AND RESEARCHERS. NOT UNTIL THE MAJOR PORTION OF THE FUNDS WERE COMMITTED AND THE DESIGNS WERE UNDERWAY WAS IT RECOGNIZED AS IMPORTANT - OR EVEN REALIZED - THAT THE CLASSROOM TEACHER HAD BEEN LEFT OUT OF THE PROCESS. YET IT IS THE CLASSROOM TEACHER WHO CAN MAKE OR BREAK CURRICULUM REFORMS. THE CLASSROOM TEACHER IS ALSO THE ONE WHO IS SUBJECT TO CRITICISM WHEN A REFORM DOESN'T WORK. TO SUCCEED, CURRICULUM REFORM AND REFINEMENT MUST INVOLVE NOT ONLY CLASSROOM TEACHERS, BUT ALSO THE PARENTS AND THE LOCAL BUSINESS COMMUNITY. THIS TIME, WHEN WE ALLOCATE FUNDS TO BRING SCIENCE AND MATH TEACHING UP TO THE DESIRED STANDARDS, WE MUST INCLUDE TEACHERS, SCHOOL BOARDS, PARENTS, AND COMMUNITY MEMBERS AT LARGE IN THE PROCESS. THERE IS NO BETTER WAY TO GAIN SUPPORT FOR SCHOOL PROGRAMS THAN TO HAVE EVERYONE INVOLVED IN THE PLANNING - AND THEREBY INVOLVED IN THE SUCCESS OR FAILURE OF OUR EDUCATIONAL EFFORTS.

6) THE FEDERAL GOVERNMENT SHOULD EMPHASIZE THE NEED FOR RAISING TEACHER SALARIES AND WORK WITH STATE LEGISLATORS IN FINDING ADDITIONAL REVENUES FOR THIS PURPOSE. WE CANNOT TALK ABOUT RAISING STANDARDS IN EDUCATION AND CONTINUE TO PAY SUBSTANDARD SALARIES.

7) AND LAST, BUT CERTAINLY NOT LEAST, WE CONCUR WITH THE TASK FORCE CREATED BY THE EDUCATION OF THE STATES COMMISSION WHICH STATES THAT SCHOOLS, BUSINESSES, AND PARENTS SHOULD BE PARTNERS IN SOLVING THE PROBLEMS OF EDUCATION. THE PUBLIC HAS BECOME VERY MUCH AWARE THAT WE ARE LOSING JOBS

> BY THE MILLIONS TO COUNTRIES LIKE JAPAN BECAUSE WE SIMPLY DO NOT HAVE THE EDUCATION AND SKILLS TO BE COMPETITIVE IN THE WORLD ECONOMY. THE BUSINESS COMMUNITY PERHAPS HAS NEVER EXPRESSED A GREATER INTEREST IN EDUCATION BECAUSE PROFITS ARE BEING TRANSFERRED TO OTHER NATIONS THAT HAVE A BETTER EDUCATIONAL SYSTEM UPON WHICH THEY CAN RELY FOR SKILLED, CREATIVE, AND TALENTED PEOPLE. IN THIS TECHNOLOGICAL WORLD, OUR VERY SURVIVAL REQUIRES THAT WE IMPROVE THE EDUCATIONAL STRUCTURE OF THE U.S. ONLY A COMBINATION OF EXCELLENT TEACHERS, APPROPRIATE SCHOOL CONDITIONS, AND A SOCIETY THAT UNIFORMLY REINFORCES HIGH ACHIEVEMENT BY BOTH STUDENTS AND TEACHERS CAN EFFECTIVELY MEET THE CHALLENGE OF INCREASING TECHNOLOGICAL LITERACY IN THIS COUNTRY.

IN CLOSING, THE NATIONAL COMMISSION REPORT SETS THE STAGE FOR SOME WORTHWHILE STUDY AND PLANNING. WE CALL UPON YOU AS NATIONAL LEADERS TO HEED THE RECOMMENDATIONS LISTED BY THE COMMISSION; AND WE CALL UPON YOU AS OUR NATION'S LEADERS TO SET THE TREND ILLUSTRATING TO THE AMERICAN PEOPLE THAT EDUCATION IS A NATIONAL PRIORITY AND THAT POSITIVE FIRST STEPS MUST BE TAKEN TO REVERSE THE SERIOUS DECLINE THAT IS CURRENTLY THREATENING OUR ECONOMIC AND NATIONAL SECURITY. WE ALSO CALL UPON OUR COLLEAGUES ACROSS THIS GREAT NATION TO JOIN WITH US IN WORKING TOGETHER WITH ALL SEGMENTS OF SOCIETY TO IMPROVE THE PLIGHT OF EDUCATION. WE SHOULD ACT IN THE SPIRIT OF THE NATIONAL COMMISSION REPORT AND NOT ENGAGE IN THE "BLAME-GAME", FOR THAT WILL ACCOMPLISH NOTHING. LET US ROLL UP OUR SLEEVES AND GO TO WORK TO ADDRESS THE ISSUES IN A POSITIVE AND CONSTRUCTIVE MANNER. WE IN TEXAS KNOW THAT WE HAVE ONLY A FEW YEARS REMAINING FOR OUR ECONOMY TO BE DRIVEN BY OIL AND RELATED PRODUCTS. AFTER THAT, THE DRIVING FORCE OF OUR ECONOMY WILL BE THE CREATION OF KNOWLEDGE, THE PROCESSING OF KNOWLEDGE, AND THE APPLICATION OF KNOWLEDGE. WE ALSO KNOW THAT IMPROVEMENT OF EDUCATION MEANS MORE THAN THE SIMPLICITY OF BACK TO THE BASICS. IT ALSO MEANS PROBLEM SOLVING, REASONING, UNDERSTANDING, APPLYING, RESTRUCTURING, AND INVENTION. WE MUST ALL BE WILLING TO ACCEPT CHANGE AND A RESTRUCTURING OF EDUCATION, NOT BECAUSE EDUCATION HAS FAILED FOR IT CERTAINLY HAS NOT, BUT BECAUSE SOCIETY ITSELF HAS RESTRUCTURED. THE RESTRUCTURING OF PUBLIC EDUCATION SHOULD BE LOOKED UPON AS A LONG-RANGE PROCESS COVERING PERHAPS A PERIOD OF TWENTY YEARS. APPROACHING THIS TASK ON A QUICK-FIX BASIS WILL SURELY NOT WORK.

AS WE MOVE INTO THIS RESTRUCTURING PROCESS WE WILL NEED TO REPLACE CONFRONTATION WITH COLLABORATION, FOR IT IS IMPORTANT THAT VARIOUS ELEMENTS OF THE EDUCATIONAL COMMUNITY AND OF THE PRIVATE SECTOR BE INVOLVED IN THE RESTRUCTURING PROCESS. WE MUST DO THIS TOGETHER FOR THE FUTURE OF OUR YOUTH, OUR NATION, AND OUR SURVIVAL. AS TEACHERS, WE ARE WILLING AND ANXIOUS TO ASSUME OUR FAIR SHARE OF THE RESPONSIBILITY FOR THIS CRUCIAL ENDEAVOR.

THANK YOU FOR THE OPPORTUNITY TO ADDRESS YOU, AND WE APPRECIATE YOUR EFFORTS IN CONFRONTING THESE ISSUES.

REFERENCES

(1) *A Study of the Availability of Teachers for Texas Public Schools*, Texas Education Agency. November, 1982

(2) *Texas Past and Future: A Survey*. Texas 2000 Commission: Office of the Governor. 1982.

(3) *The Crisis in Science and Mathematics Education in Iowa: The Problem and Recommendations*. October, 1982.

(4) L. Ray Carry, *Mathematics Teaching*. *The State of the State*. University of Texas. November, 1982.

(5) Phyllis Marcuccio. *Responding to the Economic Sputnik*. Phi Delta Kappan. May, 1983. Pg. 618-620

Senator **Bentsen**. One of the themes that has run through all your testimony is increasing interest in and the need for greater familiarization with computers and their operation. I noticed that Mr. Reagan, in particular, talked about what is happening in the Houston School District in this area.

One of the concerns that we have heard expressed here is that only the wealthy school districts will have computer instruction available for students. I have introduced legislation, and Senator Danforth has joined with me in that effort, to give tax incentives for computer companies to give computers to all school districts to avoid this problem.

Do you think that my legislation will fulfill a meaningful purpose and be of assistance in that regard?

Mr. **Reagan**. Yes, Senator. We followed this very carefully and are highly encouraged by it. If I might make this analogy or make this statement. We feel that 5 years from today we'll have the ability to teach basic facts and basic knowledge. At least 50 percent of it can be delivered over the microcomputer. And our evidence is growing and growing of the capability of this wonderful machine.

What we see happening, though, Senator, and it is going to be the greatest tragedy the Nation has ever faced, the advantaged homes are purchasing these by the droves. The disadvantaged homes are not. And while we have made substantial progress, as Barbara O'Neal said, in closing the gap between the advantaged and disadvantged, this is going to create a gap greater than the Nation has ever known. And I promise you this. I saw an 8-year-old nephew last night programing one in an advantaged home in Arlington, Va.

Senator **Bentsen**. I saw on TV last night some 5-year-old Japanese children working on those computers. I have some smart grandchildren, but I am not sure they are ready for that.

Mr. **Reagan**. We need to do everything within our power to enhance that equity of access. By all means it will work. But could we consider broadening the legislation so that anyone who gave and contributed a computer or funds for a computer would get the tax write-off?

I know of many foundations and other people, I know of many individuals who want to do this.

Senator **Bentsen**. You mean give it to the school?

Mr. **Reagan**. Yes, sir.

Senator **Bentsen**. Beyond a company level?

Mr. **Reagan**. Yes, sir.

Senator **Bentsen**. Let me take a look at that.

Mr. **Reagan**. There are many individuals that would contribute money for the purchase of computers. They realize the problem, particularly in making it available to the disadvantaged home.

Senator **Bentsen**. Let me take a look at that and see if we can feasibly broaden that.

Mr. Turnbull, you were saying that interest in math and science has never been higher. Yet, we have a substantial shortage of such teachers. What is causing that increased interest and how do you think that rising student interest in math and science is going to be accommodated?

Mr. **Turnbull**. I think that industry is the big draw for the students. The results of polls of students beginning their work in math and science on college campuses are very discouraging. Smaller and smaller numbers of them intend to go into teaching. They are proceeding into the scientific and technological fields with the idea of going into private business enterprises. I think the only way we can move them in greater numbers into teaching is through incentives, tax forgiveness incentives, incentives of low-cost loan programs, and later on, incentives, while the shortage lasts, for people to enter teaching with larger pay than the average teacher receives.

I agree with Mrs. O'Neal that the problem would be better solved by foresight, and foresight is represented by the tax forgiveness plans. However, we have some catching up to do because our foresight was inadequate. I think in order to bring us back to the state we need to attain with regard to teaching faculty, we may have to look to a repair system which I would consider to be a fair characterization of a bonus system in the areas where we have failed as a society to bring about the kind of supply needed to meet the demand.

Senator **Bentsen**. Ms. Pyle.

Ms. **Pyle**. Yes.

Senator **Bentsen**. The President's Commission on Excellence raised a couple of major issues and I would like to discuss one of them with you. First, they charge that our secondary schools have turned away from the traditional academic subjects like math to less rigorous ones, featuring little math, science, or rigor of any kind.

For example, 61 percent of high school students took at least a general science course in 1971 but only 37 percent did in 1981. Has there been a deemphasis on the three R's—reading, writing, and arithmetic—in favor of less challenging courses?

If that is the case, why has it occurred and what do we do about it?

Mr. **Pyle**. Yes, I think there has been a deemphasis on it. I do not know why it has occurred. For example, in Texas, the science requirement, if you take seventh and eighth grade science in junior high school, then you only have to take one more science course in high school in order to graduate. I think that this is a very bad situation. It does not give them the knowledge and skills that they need to go on into a highly technological area.

What do we do about it? I think we're taking some steps in Texas. The House Bill 246, the Curriculum Reform Bill, is requiring more science and more math. I believe the commission report required that the graduation requirements be raised. And I think that we're going to have to do that. And when we do that, we also create some more problems.

We must have qualified, and I want to emphasize that word, qualified math and science teachers to teach these students. The business and industry world is going to require, because of the type of business that they have, they are going to be requiring higher mathematic courses, higher science courses to be taught. We must have the teachers that are qualified to teach those. And at the present time, we have a severe shortage of them.

Senator **Bentsen**. Mrs. O'Neal, let me ask you about another comment by the President's Commission on Education. It charged that student and teacher performance has fallen, a fact that was reflected in SAT tests that were noted by Mr. Turnbull.

Have you found that the knowledge taken out of school by graduating seniors is less than it was in years past? And if that is true, is it due to a less demanding curriculum, to poor teaching, or to what we call "social promotions," moving students ahead regardless of their academic performance?

Mrs. O'NEAL. Another reason for the decline in the SAT scores has been that a broader spectrum of the American population or student population are taking those tests and that needs to be taken into account. You cannot measure it against the same students that took those courses in the 1950's.

You know, we are doing a better job of educating the masses, so to speak.

Are students taking less knowledge out of the schools? I do not necessarily think so. I think our bright and capable students are probably taking more knowledge out of the schools than they took out 10 and 15 years ago, and they are achieving at the college level.

I think we are educating low ability students at a better level than we ever have before. It is just when you take all those numbers and throw them in there together and come up with an average figure, I don't think you get the picture of what is really happening in the schools.

Senator BENTSEN. Well, Mrs. O'Neal, let me ask you a tough one in your position. Students abroad attend school longer than students here.

Mrs. O'NEAL. Yes, sir.

Senator BENTSEN. What are the hurdles, if any, to expansion of the school year?

Mrs. O'NEAL. Yes, sir. Students do need more time in school. We need longer school years and longer school days. The curriculum needs to be toughened.

Senator BENTSEN. You said that as head of the Texas State Teachers Association?

Mrs. O'NEAL. Yes, sir. The curriculum certainly does need to be tougher and I think you will find every teacher in Texas will agree with me on that.

Senator BENTSEN. And they will be paid for the extra time, I assume. That goes with it, does it not?

Mrs. O'NEAL. Yes, sir. And teachers have never really supported social promotions. They want students to do well in their classrooms and master those subjects.

Senator BENTSEN. Well, I have a lot of questions that I would like to ask this panel, but I'm going to have to forego them. I think your testimony has been very, very helpful.

One of the major problems that we have in boosting education is money. When we as parents and as society in general ask for an upgrading in education, one component of that must include making teachers' salaries competitive. I believe very strongly in that. Other reforms we should pursue are more homework, steps to improve class discipline, perhaps longer school days, and maybe longer school years. But, again, higher compensation is the first step we should take.

I am very appreciative of your insights presented today. However, we are not going to get that additional financial commitment until the people of the United States understand how important education is to retaining our role as a leader in the world and remain a very competitive economic society. We can talk about all the changes in management practices, in labor, work ethics, and computers and the rest of it. But, unless we are a technically educated society, we will not be competitive.

Thank you very much for your attendance. The subcommittee is adjourned.

[Whereupon, at 11:35 a.m., the subcommittee adjourned, subject to the call of the Chair.]

○